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THE EFFECTIVENESS OF THE OTIS, THE A. C. E.,
AND THE MINNESOTA SPEED OF READING
TESTS FOR PREDICTING SUCCESS IN COLLEGE

THESIS

Submitted by

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(B.S. in Education, Boston University, 1946)

In partial fulfillment of requirements for the
Master of Education degree

1947

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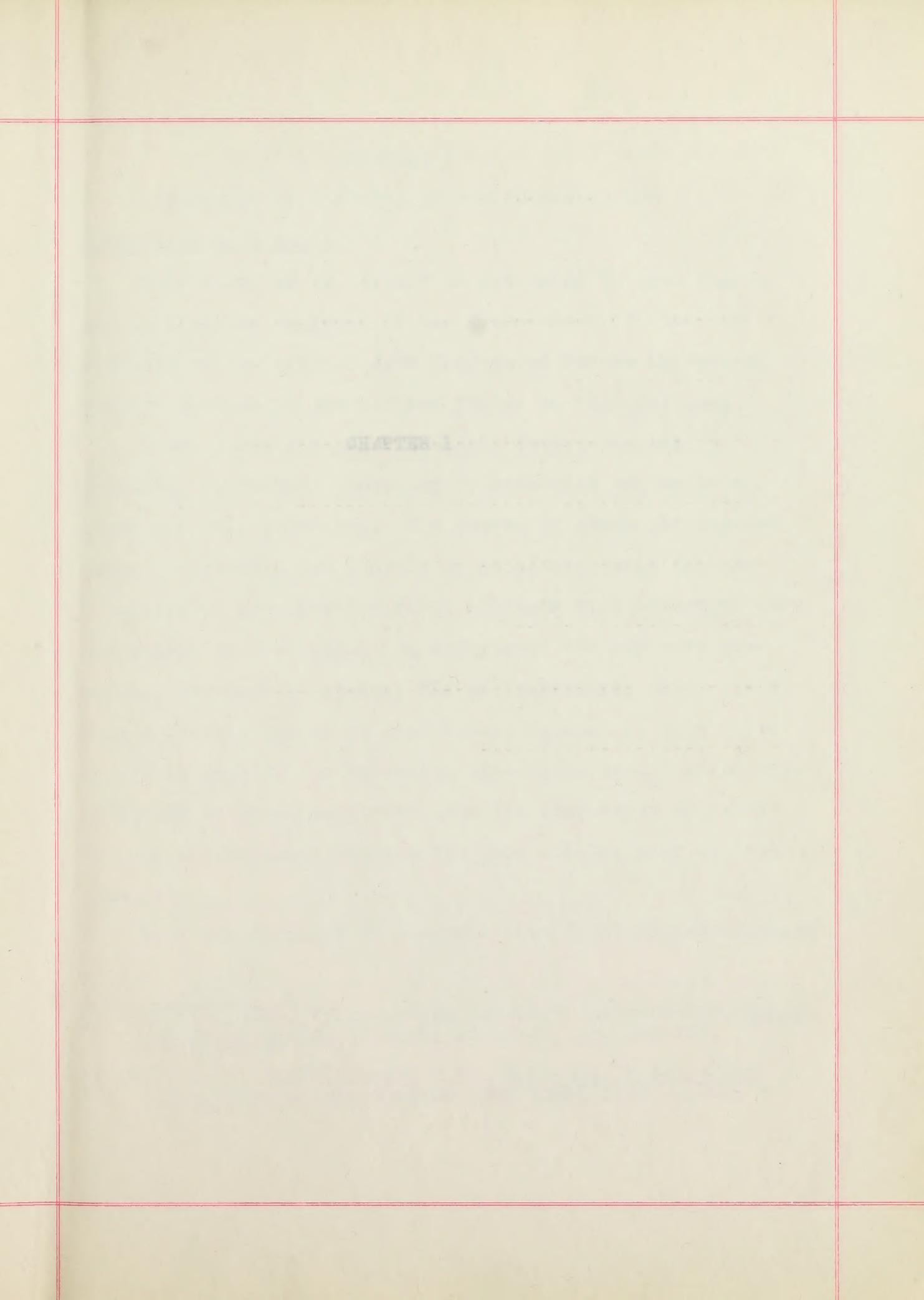
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CHAPTER I

STATEMENT OF THE PROBLEM AND JUSTIFICATION

REASONS FOR STUDY

This study is an attempt to determine to what degree the instruments employed in the measurement of incoming students at the Liberal Arts College of Boston University predict success in the various fields in that college.

CHAPTER 1

Since large groups seek admission to colleges, it becomes necessary to determine an adequate basis for this selection. The degree to which any instruments or criteria can provide an objective basis for the selection of the more desirable students will determine its usefulness in the counseling department for guidance purposes. Crawford ¹ states, "As an institution is to admit only a有限 number of candidates, it must be able first to justify its selection upon intellectual standards," selection becomes inadequate upon the predictive measures used to distinguish between the good and the poor college materials.

Cooper and Kefauver ² suggests that "general intelligence

¹ CRAWFORD, E. L., "Measuring Freshman Achievement", *Journal of Educational Psychology*, Vol. (January 25, 1930), pp. 125-132.

² COOPER, L. L. and KEFAUVER, G. S., *Guidance in Secondary Schools*, Macmillan Company, New York, 1934, p. 222.

CHAPTER 1

STATEMENT OF THE PROBLEM AND JUSTIFICATION

Purpose of This Study.

This study is an attempt to determine to what degree the instruments employed in the measurement of incoming students at the Liberal Arts College of Boston University predict success in the various fields in that college.

Since large groups of students seek admission to colleges, it becomes necessary to determine an adequate basis for this selection. The degree to which any instruments or criteria can provide an objective basis for the selection of the more desirable students will determine its usefulness in the counseling department for guidance purposes. Crawford ^{1/} states, "If an institution is to admit only a certain number of candidates, it must be able first of all to justify its selection upon intellectual standards." Selection becomes inadequate when the predictive measures fail to discriminate between the good and the poor college material.

Koos and Kefauver ^{2/} suggests that "general intelligence

^{1/} Crawford, A.B., "Forecasting Freshman Achievement", School and Society, 31, (January 25, 1930), pp. 125-132.

^{2/} Koos, L. V., and Kefauver, G. N., Guidance in Secondary Schools, Macmillan Company, New York, 1932, p. 292.

seemed to represent a practicable measure of capacity for success in college work." It seems highly probable that success in college is dependent, to a degree, upon scholastic aptitude. But other factors are known to operate.

The Influence of Other Variables.

Stegner ^{1/} concluded from his study that personality influences achievement in an indirect way by affecting the degree to which use is made of the individual's potentialities. However, he notes, "Personality measures can never be used as entrance qualifications because the student scoring high on undesirable traits are also high on aptitudes and represent the very stratum we should be developing rather than discouraging."

It seems that measures of scholastic aptitude must be utilized. There are great variations among colleges which therefore preclude the possibility of the establishment of a single criterion for all. Quaid ^{2/} points out "...Because of curricula varying both in content and difficulty in different institutions of higher education, varying medians

1/ Stegner, R., "Relation of Personality to Academic Aptitude and Achievement", Journal of Educational Research, 26, (May 1933), pp. 648-660.

2/ Quaid, T.D.D.D., "Study of Prediction of College Freshmen Marks", Journal of Experimental Education, 6, (March 1938), pp. 350-375.

of ability in freshman classes in different colleges... varying methods of teaching and standards of achievement,... no uniform criteria can be prescribed for the evaluation of ability of freshmen to succeed in all colleges or universities." But it may be possible within a narrower range to establish critical scores as a basis for this discriminative process.

Justification For This Study

Many studies have been made discussing the degree of relationship between entrance instruments used and the college grades secured by the admitted students. Since this study is based upon the utilization of the Otis Test of Mental Ability, the American Council Psychological Examination, and the Minnesota Speed of Reading Test as the measuring instruments, relevant findings will be discussed.

Basic Assumption.

One basic assumption is to be noted in all the studies dealing with the predictive qualities of certain measures.

The criteria against which this relationship is observed is the grade or the course mark the student receives.

Various studies of teacher's marks indicate the unreliability of this criteria, but marks are the only available means of noting the achievement in a course from the record. Rogers 1/

1/ Rogers, H.W., "Reliability of College Grades", School and Society, 45, (May 29, 1937), pp. 758-760.

averaged the reliability of college grades for eight semesters and found a correlation of .66. The correlation decreased as the interval between the terms increased, with the decrease being constant.

Reviewing the Research.

Freeman's ^{1/} study noted the extent to which the A.C.E. indicates the possibilities that a student will satisfy the requirement of his college. He found a relationship between the A.C.E. and college grades for the first semester of .44, second semester, .46, with a negligible relationship after the first two years "due to the fact that selective elimination has been operating, thus resulting in a more homogeneous group seen in reduced coefficient of relationships."

By way of comparison Stelnaker ^{2/} found a relationship as high as .57 between the A.C.E. and college grades for the first semester. Disparity between the various findings is to be seen. Greene ^{3/} comments in Measurement of Human Behavior that predictive correlations of .70 are usually as high as can be expected. Much of the reported data seems to

^{1/} Freeman, F.S., "Predicting Academic Survival", Journal of Educational Research, 23, (February 1931), pp. 113-123.

^{2/} Stelnaker, J.M., "American Council Psychological Exam", School and Society, 27, (January 21, 1928), pp. 86-88.

^{3/} Greene, Edward B., Measurement of Human Behavior, Odyssey Press, New York, 1941, p. 256.

fail to reach that high a correlation.

Thurstone ^{1/} noted in his discussion of the 1929 A.C.E., "That when the grading standards of a college are maintained with fair uniformity among the different courses, the correlations between tests and grades should be between .40 and .60. ...The wide range of ability within the freshman class, where failure students are not eliminated by entrance examinations, results in a lower correlation."

Melvin Rigg calculated correlations between intelligence scores using the A.C.E. and grades for seven successive graduating classes in a small college for men. He noted that the correlations between intelligence and the first semester's scholarship are higher than those between intelligence and four year's scholarship.

"Table Showing Correlations" ^{2/}

Classes	Intelligence and First Semester Scholarship		Intelligence and Four Year Scholarship	
	N	r	N	r
1	112	.50	32	.41
2	105	.60	37	.53
3	85	.36	36	.32
4	82	.63	27	.41
5	77	.38	36	.46
6	77	.64	31	.67
7	77	.54	29	.22
Average		.53		.43
Composite			228	.42

^{1/} Thurstone, L.L. and Thurstone, G.L., "The 1929 Psychological Examination", Educational Record, 11, (April 1930), pp. 101-128.

^{2/} Rigg, Melvin G., "The Relation of College Achievement Tests to Grades and to Intelligence", Journal of Educational Psychology, 30, (May 1939), pp. 397-400.

Gerberich ^{1/} computed a Pearson product-moment correlation of the A.C.E. scores of three entering freshman groups at the University of Arkansas and weighted grade point averages. The coefficients of correlation for the three groups were .463, .575, and .546. Gerberich states, "The coefficients indicate that experience with the predictive power of these widely used entrance tests at the University of Arkansas has been typical of experience elsewhere."

Among the five variables Quaid ^{2/} used to determine the efficacy of measures in the prediction of college freshmen marks were the A.C.E. and the first semester's grades. The Ohio State Psychological ranked first as predictive instrument with a correlation of .473, the high school averages ranked second with a correlation of .385, while the A.C.E. ranked third with an "r" of .367.

Schmitz's ^{3/} study gave the comparative value of several criteria for predicting success in college. He found the A.C.E. ranked second as a criterion of success, having a correlation of .583 with college grades. His study revealed the fact that the A.C.E. was only slightly better than

^{1/} Gerberich, J.R., "Factors Related to the College Achievement of High-Aptitude Students Who Fail of Expectation and Low-Aptitude Students Who Exceed Expectation", Journal of Educational Psychology, 32, (April 1941), pp.253-265.

^{2/} Quaid, T.D.D.D., op. cit. pp.350-375.

^{3/} Schmitz, Sylvester B., "Predicting Success in College", Journal of Educational Psychology, 28, 1937, pp.465-473.

the Army Alpha as a criterion of success in college.

Part of Goodman's ^{1/} findings revealed a correlation of .54 between the Otis Test of Mental Ability and English Composition. He felt the Otis correlated more highly with semester averages ,+.53, than do any other tests of the vocational guidance battery.

Summarizations of the correlations of general intelligence measures with grade scores to predict success in college were reported by MacPhail.^{2/} He concluded, "The central tendency of these correlations is from .40 to .45. Only a very few fall below .30 and a number are reported as high as .60 or more. Over two-thirds of the correlations fell between .30 and .50."

He points out, "The lower correlation may be caused by the failure of those of highest intelligence to achieve on a commensurate level or because those with lowest intelligence, through good study habits, or persistance, achieve more highly than the test scores may indicate."

1/ Goodman, Charles H., "Prediction of College Success by Means of Thurstone's Primary Abilities Tests", Educational and Psychological Measurement, 2, 1944, pp.125-140.

2/ MacPhail, Andrew H., The Intelligence of College Students, Warwick and York, Baltimore, 1924, p.28.

Objectives of This Study

In the studies cited, typical to those found in the literature, the correlations between the test scores and college grades were found on one semester's or a total year's or four years' averages. No study points out the degree of relationships between subject matter fields over the total period with the psychological measures utilized in this study.

Further, the review of various articles fails to note any degree of difference that might exist within these subject matter fields between the good and the poor achievers. If a difference does exist, is it significant? Is there a level above which, or below which, scores in a subject matter field being obtained, might be useful for guidance purposes since they do indicate a trend?

This study attempts to discover what, if any, relationship exists between the Minnesota Speed of Reading Test and the grade score achievement in the various subject matter fields; between the Otis Test of Mental Ability and the grade score achievement in the various subject matter fields.

Nature of the Sample.

It should be noted that this study differs in one major respect from those reported in the literature on similar types of measuring instruments. The group under consider-

ation, during this study, entered college in 1943. Therefore other factors, required military service, entered into the picture and of necessity altered the total picture. Thus the group entering in 1943 cannot be considered a normal population sample. This can be seen by noting the sex differentiation in numbers.

Specific Aims.

This study aims: ~~CHAPTER 11~~

1. to determine the degree of relationship between the Otis Test of Mental Ability and subject matter fields;
2. to determine the degree of relationship between the A.C.E. and subject matter fields;
3. to determine the degree of relationship between the Minnesota Speed of Reading Test and the subject matter fields;
4. to note any significant differences within a subject area between the high achievers and the low achievers using the Otis Test of Mental Ability as the distinguishing measure;
5. to note any significant differences within a subject area between the high achievers and the low achievers using the A.C.E. as the distinguishing measure; and,
6. to note any significant differences within a subject area between the high achievers and the low achievers using the Minnesota Speed of Reading Test as the distinguishing measure.

CHAPTER 11
PLAN OF STUDY

Sources of Information.

The Student Counseling Department of Boston University made available the records of test data for the group entering in 1945. This particular class was selected since more complete information was available.

The test measures CHAPTER 11 for this study included the Otis Test of Mental Ability, the American Council Psychological Evaluation, the Minnesota Speed of Reading Test, and the Brown Study-Habits Inventory. Due to insufficient data on the Wechsler-Bellarus, this source was not utilized.

The grade scores were taken directly from the individual student records filed in the Registrar's Office in the College of Liberal Arts, Boston University.

Description of Test Measures Used in the Study.

The Otis Quick-scoring Mental Ability Test,¹⁷ which is a revision of the Otis Self-Administering Test of Mental Ability, consists of 80 multiple-response items which can be administered in thirty minutes and yields an I. Q. A copy of the test and the manual will be found in the appendix.

¹⁷ Published by World Book Company, Yonkers-on-Hudson, New York, 1937.

The American Council Psychological Examination, widely

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^{1/} Published by World Book Company, Yonkers-on-Hudson, New York, 1937.

Wrenn, J. Gilbert, Mimeographed Bulletin, Stanford University Press, Stanford University, California.

The American Council Psychological Examination,^{1/} widely used with college freshmen, is based upon observation and research which indicates that two kinds of scholastic aptitudes are related to success in a variety of school subjects. These are linguistic or verbal aptitude, and quantitative or numerical aptitude. The A.C.E. is a timed test which yields an L-score or a score for linguistic ability, a Q-score or a score for quantitative ability, and a total score. A copy of the test will be found in the Appendix.

The Minnesota Speed of Reading Test,^{2/} developed by Alvin C. Eurich, is a six-minute test designed to measure the rate of reading. Two forms are available for college students. A copy of the test and the manual will be found in the Appendix.

The original intention was to get a measure of relationship between the Wrenn Study-Habits Inventory ^{3/} and grade scores. It is with regret that the author denies the validity of the instrument, so the measure cannot be used in this study. A bulletin ^{4/} published by the author, states, "The

1/ Published by the American Council on Education, 744 Jackson Place, Washington, D.C.

2/ Published by the University of Minnesota Press, Minneapolis, Minnesota, 1936.

3/ Published by the Stanford University Press, Stanford University, California, 1941.

4/ Wrenn, C. Gilbert, Mimeographed Bulletin, Stanford University Press, Stanford University, California.

Inventory's structure and purpose are not adaptable for a research instrument." A copy of the bulletin will be found in the Appendix.

Procedure.

The criterion data were collected eliminating cases on which complete information was not available.

The Professor's grade for a course in which each student enrolled and for which he received credit was reduced to a total grade point average for each of the six subject areas using the twelve point scale already employed by the college.

A	4.0
A-	3.7
B+	3.3
B	3.0
B-	2.7
C+	2.3
C	2.0
C-	1.7
D+	1.3
D	1.0
D-	0.7
F	0.0

The subject matter fields were grouped under the six areas of English, Social Studies, Language, Mathematics, Science, and Fine Arts. The Physical Education averages were not used in this study.

Many studies reviewed reported statistics based upon semester averages or total averages of all marks received over a period of time. Since there seems to be no accepted

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method of determining the reliability of marks as a final measure of scholastic ability, and it can be assumed that wide variations exist in the value of marks from different sources within any one institution, this study aimed to separate grade scores in each of the six subject matter areas. This does not eliminate the error within a single area, but it does not indiscriminately group all marks received for the total period from all the courses in which a student enrolled and for which he received credit.

^{1/} Guilford ^{1/} points out the faulty nature of many studies in this respect.

"There is another factor working against fair tests of validity. ..This factor is indiscriminate pooling of marks from different subjects and from different instructors and treating them as if they were of the same coin. Any cursory inspection of grade distributions in a single institution of learning will show that marks are not by any means of constant value when obtained from different sources."

This study aims at avoiding the mistake which Guilford ^{1/} points out.

Treatment of Data.

Measures of central tendency and measures of variability for the chronological ages, the Otis Test of Mental Ability, the American Council Psychological Examination, the Minnesota Speed of Reading, and each of the six subject

^{1/} Guilford, J.P., Fundamental Statistics in Psychology and Education, McGraw-Hill, New York, 1942, p.250.

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matter areas were computed.

The Pearson product-moment technique was employed to find the relationship between the three test measures and grade point averages. The grade point averages used in the correlations were based on the total period from September, 1943 to June, 1946 within each of the six subject matter areas.

These correlations will be compared with those reported in other studies. The central tendency of the reported correlations between first semester marks and test measures has been found to vary from .40 to .45,^{1/} which may be used as one interpretative aid in this study.

There is little argument that those students who attain grades of B+ or better and those students with grades of C- or lower are really different kinds of students. This study aims to point out the degree of difference existing between these two groups. Means in each of the six subject matter areas were computed for those classified as high achievers, or those having an average of 3.3, B+ or above, and those classified as low achievers, or those having an average of 1.7, C- or below. Tests for determining the significance of the differences between these two groups were applied in each of the subject areas for each of the three test measures used.

1/ MacPhail, Andrew H., op. cit. p.28.

In the interpretation of the data derived from this investigation, a Critical Ratio of 3.00 or better was considered statistically significant in light of the following information:^{1/}

"If a given difference between hypothetical and observed values would occur as a result of chance only one time out of one hundred, or less frequently, we may say that the difference is significant. This means that the results are not consistent with the hypothesis we have set up. If the discrepancy between theory and observation might occur more frequently than one time out of one hundred solely because of the play of chance, we may say the difference is not clearly significant. The results are not inconsistent with the hypothesis. The value of T (the difference between the hypothetical value and the observed mean, in units of the standard error of the mean) corresponding to a probability of 1/100 is 2.576. One hundredth part of the area under a normal curve lies at a distance from the mean, on the axis, of 2.576 standard deviations or more. Accordingly, tests of significance may be applied with direct reference to T, interpreted as a normal deviate (i.e., as a deviation from the mean of a normal distribution expressed in units of standard deviation). A value of T of 2.576 or more indicates a significant difference, while a value of less than 2.576 indicates that the results are not inconsistent with the hypothesis in question."

The .26 per cent level of significance selected in this study for evaluation of the Critical Ratio findings means that a C.R. of 3.0 could occur by chance but once in 376 cases.

Summary.

This study is concerned with the predictability of the

^{1/} Mills, Frederick C., Statistical Methods, (Revised) Henry Holt and Company, New York, 1938, p. 471.

three measuring instruments used by the Student Counseling Department: The Otis Test of Mental Ability, the American Council Psychological Examination, and the Minnesota Speed of Reading Test.

As a measure of student achievement, the grade scores of the period from September 1943 to June 1946 were reduced to total grade point averages in each of the subject areas of English, Social Studies, Language, Mathematics, Science, and Fine Arts using the scale already employed by the college.

Means of the group for chronological ages, the Otis I.Q., the total on the A.C.E., the scores on the Minnesota Reading Test, and each of the subject matter fields were computed with the standard deviation of each.

Correlations between each of the six subject areas and each of the three test measures were computed.

High average groups, achieving a grade point average of 3.3, B+ or better, and low average groups achieving grade point averages of 1.7, C- or below, in each of the six subject areas for each of the test instruments were used to point out significantly the good versus the poor students.

The .26 per cent level of significance, a C.R. of 3.0, was selected for the evaluation of the Critical Ratios in this study.

CHAPTER III

CORRELATION AND CRITICAL RATIO TECHNIQUE

Description of the Group

The group used in this study were the Freshmen class entering in September, 1943. The equality of the population can be seen by noting the sex differentiation in numbers. The group was composed of 189 girls and 34 boys with a total age range from 16 to 22. Figure 1 illustrates the age distribution of the class.

CHAPTER III

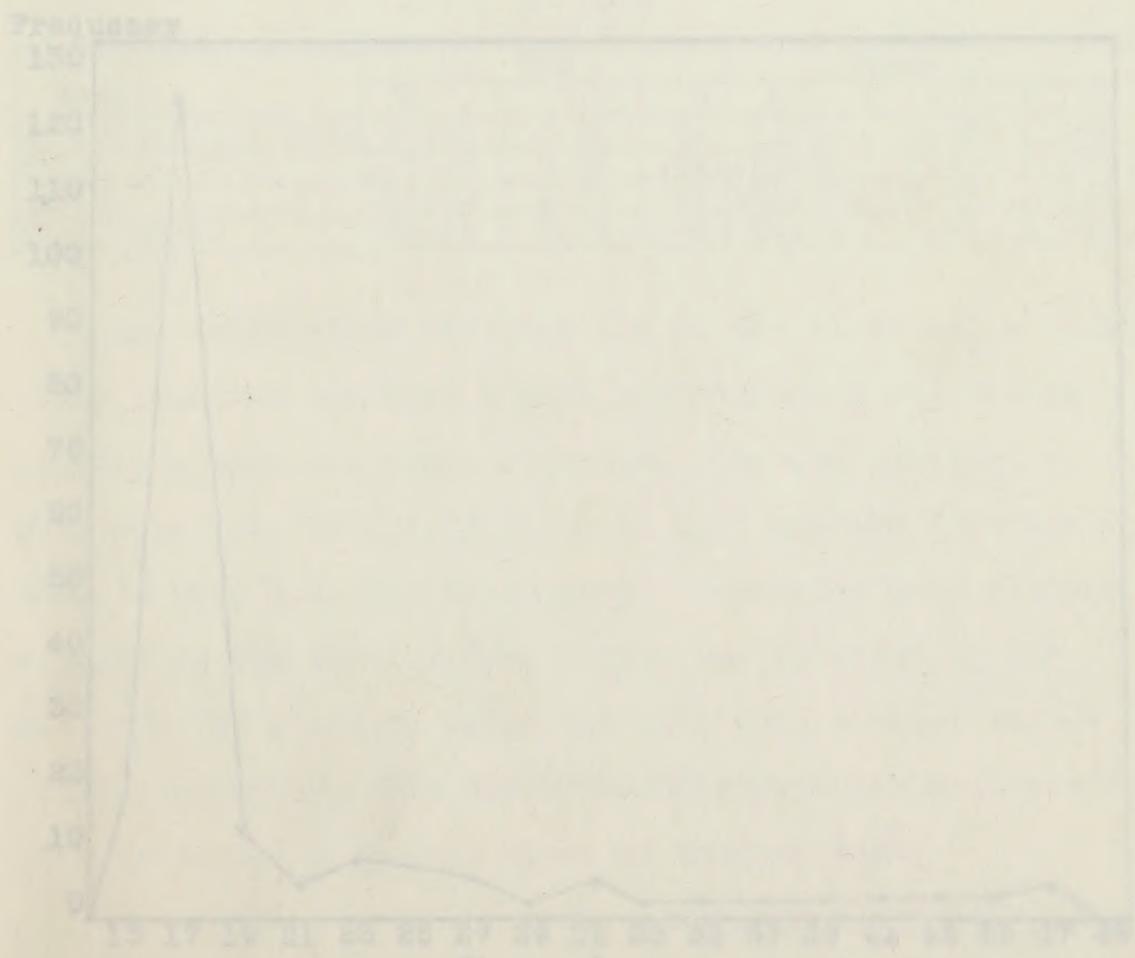


Figure 1

Frequency Distribution of Chronological Ages of 223 Students Entered in 1943 in the College of Liberal Arts, Kansas State

CHAPTER III

CORRELATION AND CRITICAL RATIO TECHNIQUE

Description of the Group

The group used in this study were the freshmen class entering in September, 1943. The abnormality of the population can be seen by noting the sex differentiation in numbers. The group was composed of 129 girls and 34 boys with a total age range from 15 to 48. Figure 1 illustrates the age distribution of the class.

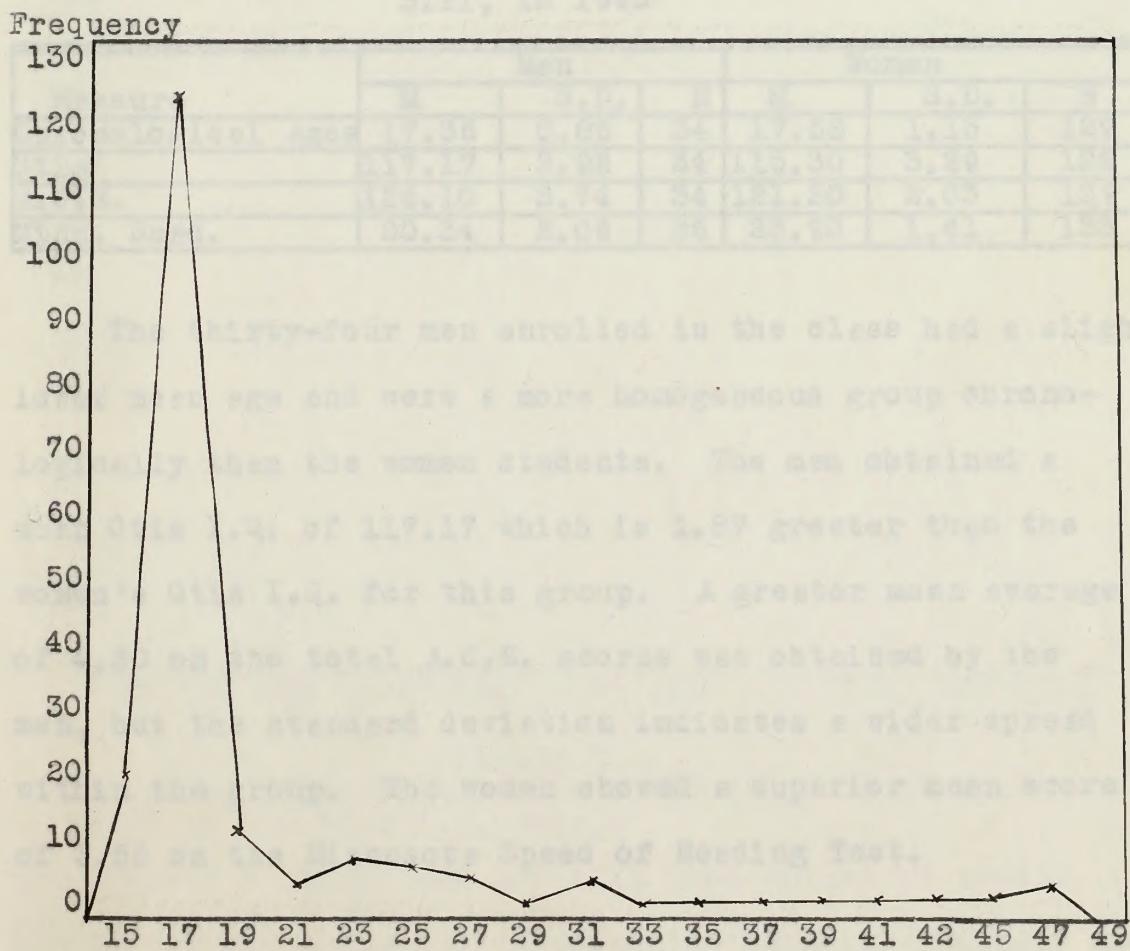


Figure 1
Frequency Distribution of Chronological Ages of 163 Students Entered in 1943 in the College of Liberal Arts, Boston University

Figure 1 graphically illustrates the pile-up in age range in the 17-19 intervals with a sudden decrease in ages represented through to 27 years, with only two exceptions above that interval.

This group also exhibited a sex differentiation on the basis of the three test instruments used. Means and standard deviations in Table 1 illustrate this point.

Table 1
MEANS AND STANDARD DEVIATIONS OF THE CHRONOLOGICAL AGES AND TEST INSTRUMENTS OF THE MEN AND THE WOMEN ENROLLED IN THE CLASS ENTERING THE COLLEGE OF LIBERAL ARTS, BOSTON UNIVERSITY, IN 1943

Measure	Men			Women		
	M	S.D.	N	M	S.D.	N
Chronological Ages	17.36	0.85	34	17.58	1.13	129
Otis	117.17	2.92	34	115.30	3.29	129
A.C.E.	126.10	3.74	34	121.20	2.03	129
Minn. Read.	20.34	2.06	26	23.90	1.61	123

The thirty-four men enrolled in the class had a slightly lower mean age and were a more homogeneous group chronologically than the women students. The men obtained a mean Otis I.Q. of 117.17 which is 1.87 greater than the women's Otis I.Q. for this group. A greater mean average of 4.20 on the total A.C.E. scores was obtained by the men, but the standard deviation indicates a wider spread within the group. The women showed a superior mean score of 3.56 on the Minnesota Speed of Reading Test.

Throughout the distribution using the Otis instrument, the lowest reported I.Q. was 88, while the highest reported

Distribution of Test Scores for Total Group.

Frequency distributions for the Otis Test of Mental Ability, the A.C.E., and the Minnesota Speed of Reading Test illustrates the homogeneous nature of the total group on these three instruments. Figure 2 points out the distribution of the population on the basis of the Otis I.Q. scores.

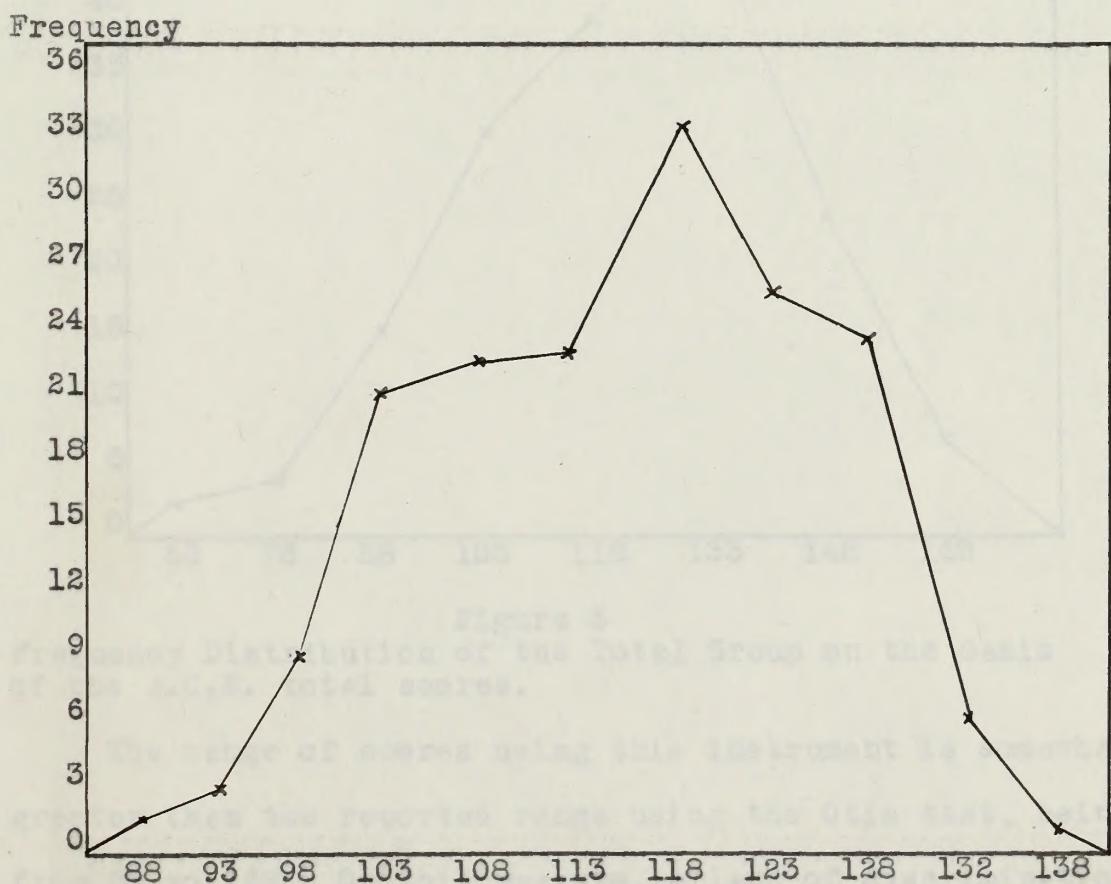


Figure 2
Frequency Distribution of the 163 Students on the Basis of the Otis I.Q. scores

Figure 2 points out a fairly even spread of scores throughout the distribution using the Otis instrument. The lowest reported I.Q. was 88, while the highest reported

was 137.

The American Council Psychological Examination scores for this group tend to spread in a similar fashion, but with greater smoothness in the curve.

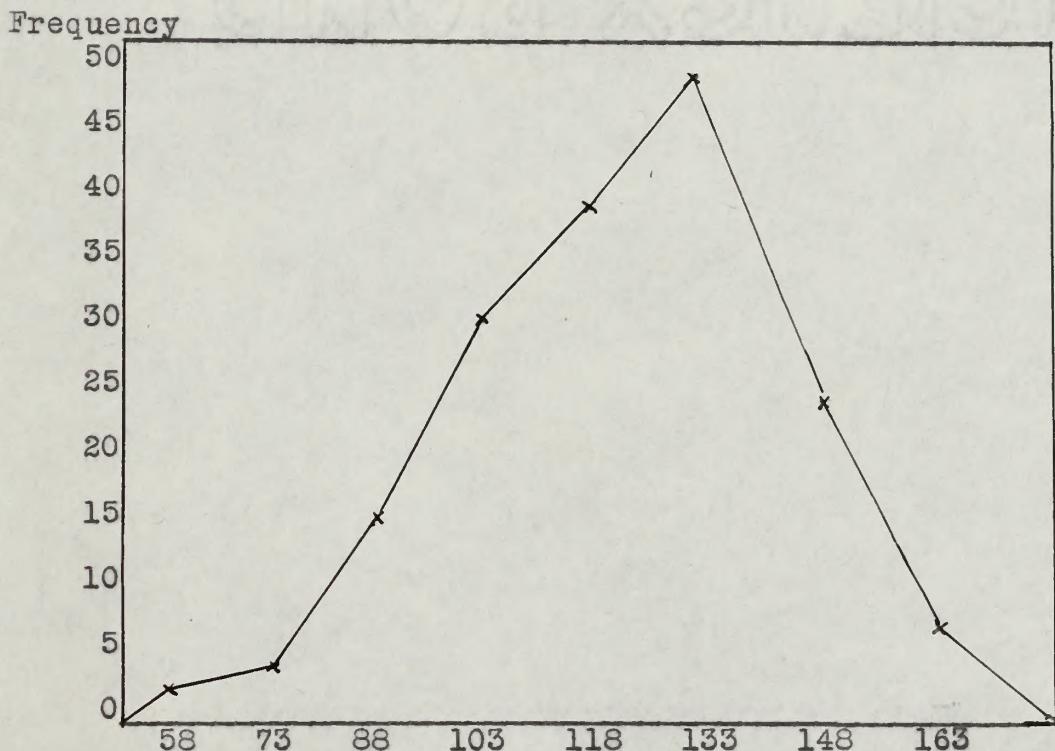


Figure 3

Frequency Distribution of the Total Group on the Basis of the A.C.E. total scores.

The range of scores using this instrument is somewhat greater than the reported range using the Otis test, being from 55 to 168. On this measure, a lack of discrimination is seen in the cases above the mean, as compared with the slightly greater differentiation in the group below the mean.

Similar findings as to the spread of the group can be noted in the Minnesota Speed of Reading scores for the entire group.

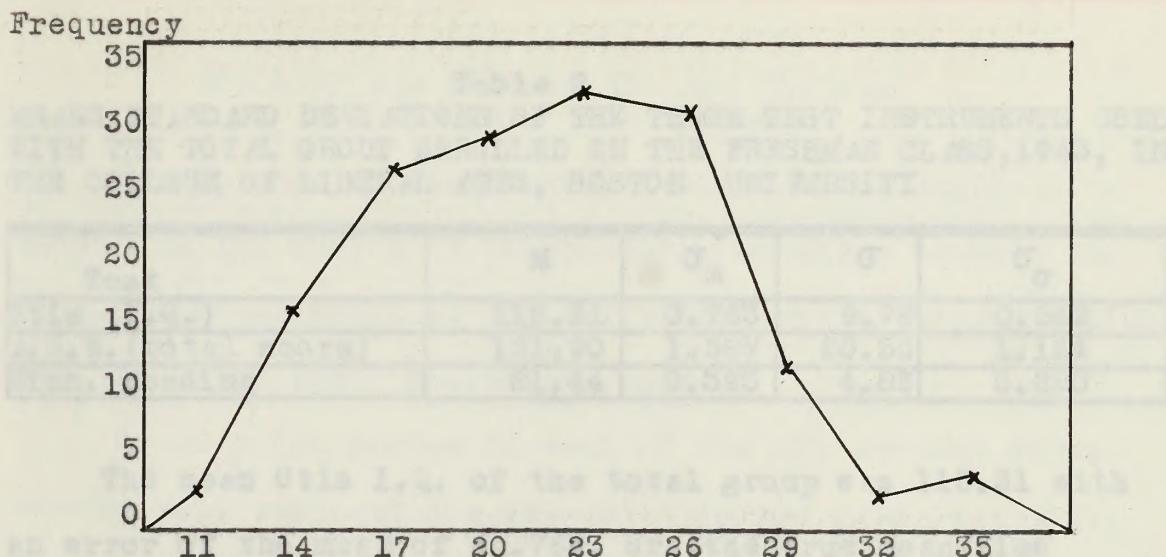


Figure 4
Frequency Distribution of the Scores on the Minnesota Speed of Reading Test for the Total Group.

The group were closely distributed about a mean which occurs in the 22-24 intervals. The close nature of the grouping about the mean, which is similar to the results seen on the other two test instruments, might be due to the homogeneous nature of the group.

Means and Standard Deviations of the Test Measures.

The averages and the spread of scores on the three test instruments were computed to determine the class standing in this respect.

In the Minnesota Speed of Reading the mean for the total group was 23.44 with a standard deviation of 4.88. With respect to the reported norms based on College Sophomores and Juniors in the University of Minnesota, this group falls above the median.

Table 2

MEANS, STANDARD DEVIATIONS OF THE THREE TEST INSTRUMENTS USED WITH THE TOTAL GROUP ENROLLED IN THE FRESHMAN CLASS, 1943, IN THE COLLEGE OF LIBERAL ARTS, BOSTON UNIVERSITY

Test	M	σ_m	σ	σ_{σ}
Otis (I.Q.)	115.31	0.763	9.78	0.542
A.C.E. (total score)	121.90	1.587	20.30	1.124
Minn. Reading	21.44	0.395	4.83	0.280

The mean Otis I.Q. of the total group was 115.31 with an error of the mean of $\pm .763$, or, the true mean lies between 114.547 and 116.073 sixty-eight per cent of the time. The spread of scores shows that the groups approaches normality in this respect, for $\pm 2\frac{1}{2}S.D.$ includes all of the group above the mean, while -3 S.D. encloses the group below the mean.

The mean of the A.C.E. total score was 121.90 with a larger standard deviation of 20.30, or, 68 per cent of the cases fall between 101.60 to 142.20. However, the spread of scores is similar to that on the Otis, for $\pm 2\frac{1}{2}S.D.$ includes all the cases above the mean, while -3 S.D. encloses the group below the mean.

On the Minnesota Speed of Reading the mean for the total group was 21.44 with a standard deviation of 4.83. With respect to the reported norms based on College Sophomores and Juniors in the University of Minnesota, this group ranks above the median.

3 sides
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MEASURES OF CORRELATION
Correlations Between the Six Subject Areas and the Test Scores

The Pearson product-moment technique was employed to determine the degree of relationship existing between the grade point averages in the different subject matter fields and the three test instruments used.

Grade point scores in each of the six subject matter fields were averaged for the total period from September, 1943 to June, 1946. Table 3 shows the degree of relationship existing between each of the three test measures and each of the six subject areas.

Table 3

CORRELATIONS BETWEEN THE SIX SUBJECT MATTER AREAS AND THE THREE TEST INSTRUMENTS FOR THE TOTAL GROUP OVER A PERIOD FROM SEPTEMBER, 1943 TO JUNE, 1946 IN THE COLLEGE OF LIBERAL ARTS, BOSTON UNIVERSITY

Subject-Matter Area	Otis	A.C.E.	Minn.
English	+.291	+.325	+.542
Social Studies	+.423	+.501	+.393
Languages	+.230	+.222	+.423
Mathematics	+.237	+.324	+.194
Science	+.531	+.442	+.452
Fine Arts	+.381	+.364	+.317

All correlations between the three test instruments and the six subject matter fields are positive and spread from the lowest "r" of .194 between the Minnesota Speed of Reading test and Mathematics, to .542 between the Minnesota Reading Test and English.

Using the Otis instrument as the discriminating

measure, there are but two marked correlations, $\neq .423$ with Social Studies, and $\neq .531$ in the Science area. Some degree of relationship exists in the other four fields, but they are not marked nor significant.

Correlations of $\neq .501$ in Social Studies field and $\neq .442$ in the Science area are the only two marked relationships using the A.C.E.

Three coefficients of correlation using the Minnesota Speed of Reading instrument are to be noted, $\neq .542$ with English, $\neq .423$ with Language, and $\neq .452$ with Science.

Intercorrelations Between Test Measures and Between Chronological Ages

Interrelationships between the three test measures, the Otis Test of Mental Ability, the A.C.E., and the Minnesota Speed of Reading Test, and relationships between each measure and chronological ages were computed and compared in Table 4.

Table 4
CORRELATIONS BETWEEN THE THREE TEST MEASURES AND CORRELATIONS OF EACH WITH CHRONOLOGICAL AGES OF THE TOTAL GROUP ENROLLED IN 1943 IN THE COLLEGE OF LIBERAL ARTS, BOSTON UNIVERSITY

Criteria	Otis	A.C.E.	Minn. Reading
Chronological Ages	$\neq .09$	$-.19$	$-.233$
Otis	$-$	$\neq .652$	$\neq .432$
A.C.E.	$-$	$-$	$\neq .394$

The lack of significant relationship is to be noted in the correlations of $\neq .09$ between the Otis test and chrono-

nological ages. Negative correlations between the A.C.E. and chronological ages of $-.19$, and $-.233$ between the Minnesota Reading Test and chronological ages are to be observed from the table.

The Otis Test of Mental Ability correlated $+.652$ with the A.C.E., but the relationship is not high enough to indicate a great degree of confidence in the forecasting efficiency between the two criteria. The Otis and the Minnesota Speed of Reading Test correlated higher than did the A.C.E. and the Minnesota, but neither correlations are high enough to be marked.

Critical Ratio Findings

Significant Differences Within the Group.

This study originally aimed to determine to what degree, if any, withdrawal students showed a difference in ability as compared with those who stayed in college. The cumulative record did not give sufficient information as to allow a division of the withdrawal group into failing students and students who left due to other reasons, economic, trans-ferral, or military service, so a different method was used.

The total group in a given subject area was divided into the high achievers and the low achievers on the basis of the grade point averages attained by each student in each of the six subject areas. The high achievers were considered to be all those with a grade point average of

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3.3, B+ or above, while the low achievers were considered to be all those with a grade point average of 1.7, C- or below, in a given subject matter area.

Each of the six subject matter fields for each of the three test instruments as the discriminating criteria were treated in this manner using Mills' technique. The following tables illustrate the computation of the Critical Ratio process and the results of this treatment in each subject with each of the three test measures employed.

English Area.

Table 5
SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS WITH THE OTIS FOR THE HIGH AND THE LOW AVERAGE ENGLISH GROUPS, 1943-1946

M ₁	σ_{m_1}	σ_1	N ₁	Diff. $M_1 - M_2$	σ Diff.	C.R.
120.50	0.395	2.28	34			
M ₂	σ_{m_2}	σ_2	N ₂	8.96	0.603	14.859
111.54	0.457	2.82	38			

The means, standard deviations, and errors of the mean for the high average and the low average English groups using the Otis measure were computed. The critical ratio obtained was 14.859. As this study considered as significant a C.R. of 3.0 or better, this result is extremely significant. Since a C.R. of 5.0 could have occurred by chance but one in 1,743,982 cases, this means the hypothesis, that the difference could be attributed to chance, is not substantiated. A mean Otis I.Q. of 120.5 ± .395 includes

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those students who received $B+$ or better grades in English, while an Otis I.Q. of 111.52 $\pm .457$ marks a critical point at which students received a grade of C- or below in this subject area in this college.

Differences between the high and the low average English groups using the A.C.E. measure were computed. Table 6 illustrates the method and the results of the technique.

Table 6
SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE A.C.E.
WITH THE HIGH AND THE LOW AVERAGE ENGLISH GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	σ Diff.	C.R.
132.85	0.43	2.52	34	18.95	0.69	27.46
M_2	σ_{m_2}	σ_2	N_2			
113.90	0.541	3.34	38			

Using the A.C.E. as the distinguishing measure of the high and the low average groups in English, a Critical Ratio of 27.46 was obtained. This result is highly significant at the .26 per cent level selected. This indicates students with a mean total score of 132.85 $\pm .43$ are more certain to fall in the high average group in English than the student with a mean total score of 113.90 $\pm .541$ on the same instrument.

Using the Minnesota Speed of Reading Test, the means, standard deviations, and errors of the measures were utilized to determine the significance of the differences between these two groups in this same subject area.

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Table 7
SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE
MINNESOTA SPEED OF READING TEST WITH THE HIGH AND THE
LOW AVERAGE ENGLISH GROUPS

M_1	σ_{m_1}	σ_1	N_1	$Diff. M_1 - M_2$	$\sigma_{Diff.}$	C.R.
22.88	0.67	3.83	33	3.59	0.913	3.932
M_2	σ_{m_2}	σ_2	N_2			
19.29	0.62	3.60	34			

Using the mean scores on this test, a significant difference of 3.932 was obtained. This mean Speed of Reading score of $22.88 \pm .67$ can be considered a critical point at and above which a student was successful in English, while those were non-successful who obtained a mean score of $19.29 \pm .62$ on this same instrument.

Social Studies Area.

In the subject matter area of Social Studies, mean differences were compared using the Otis, the A.C.E., and the Minnesota Speed of Reading Tests. The following tables illustrate the procedures employed and the results obtained.

Table 8
SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE OTIS
WITH THE HIGH AND THE LOW AVERAGE SOCIAL STUDIES GROUPS

M_1	σ_{m_1}	σ_1	N_1	$Diff. M_1 - M_2$	$\sigma_{Diff.}$	C.R.
122.02	0.72	3.94	30	11.35	1.047	10.838
M_2	σ_{m_2}	σ_2	N_2			
110.67	0.76	3.25	18			

The critical ratio of 10.838 in the Social Studies area using this instrument is considered highly significant. Students obtaining a mean Otis I.Q. of $112.02 \pm .72$ may utilize this information since this score represents an average at and above which this group of students succeeded. The critical point of $110.67 \pm .67$ indicates a level below which this group received low or failing grades in this subject.

Using the A.C.E. instrument an extremely significant result was also obtained.

Table 9
SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE A.C.E. WITH THE HIGH AND THE LOW AVERAGE SOCIAL STUDIES GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	$\sigma_{\text{Diff.}}$	C.R.
136.50	0.41	2.24	30	28.30	0.616	45.94
M_2	σ_{m_2}	σ_2	N_2			
108.20	0.46	1.94	18			

The critical ratio between the differences of the means of the Social Studies groups using the A.C.E. as the distinguishing measure was 45.94 which is extremely significant at the level selected. A student with a mean total score of $136.50 \pm .41$ is more certain to obtain higher grades in Social Studies than the student having a mean A.C.E. total score of $108.20 \pm .46$.

The Minnesota Speed of Reading Test continued to distinguish between these two groups of students.

Table 10

SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE MINNESOTA SPEED OF READING TEST WITH THE HIGH AVERAGE AND THE LOW AVERAGE SOCIAL STUDIES GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	$\sigma_{\text{Diff.}}$	C.R.
22.84	0.42	2.26	29			
M_2	σ_{m_2}	σ_2	N_2	3.72	0.948	3.915
19.12	0.85	3.51	17			

The difference between the means over the standard error of the difference using the Minnesota Speed of Reading Test for these students in the Social Studies area resulted in a C.R. of 3.915 which is considered significant.

Language Area.

The students enrolled in the Language courses were divided into the same two groups using each of three test measures. Tests of significance were applied to the differences between the means for each group with each instrument.

Table 11

SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE OTIS TEST WITH THE HIGH AVERAGE AND THE LOW AVERAGE LANGUAGE GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	$\sigma_{\text{Diff.}}$	C.R.
118.61	0.503	3.19	40			
M_2	σ_{m_2}	σ_2	N_2	6.27	0.76	8.25
112.34	0.572	3.24	32			

A lesser difference, but with still a highly significant critical ratio of 8.25 was found in the Language field using the Otis test. It is possible to note that a student with a mean Otis I.Q. of 112.34 $\pm .572$ falls in or near the failing group, while a mean Otis I.Q. of 118.61 $\pm .503$ indicates the more successful student in the Language area with this group.

Using the A.C.E. as the discriminating measure between the high and the low average Language groups, an extremely significant C.R. was found.

Table 12

SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE A.C.E. WITH THE HIGH AND THE LOW AVERAGE LANGUAGE GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	$\sigma_{\text{Diff.}}$	C.R.
129.80	0.284	1.80	40	14.90	0.496	30.04
M_2	σ_{m_2}	σ_2	N_2			
114.90	0.413	2.34	32			

The difference of 30.04 is a highly significant difference between the means of the A.C.E. with the high and the low average groups. A student having a mean A.C.E. total score of 129.80 $\pm .284$ is more likely to be successful in the study of Languages than the student with a mean A.C.E. total score of 114.90 $\pm .413$.

Table 13
SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE
MINNESOTA SPEED OF READING TEST WITH THE HIGH AND THE LOW
AVERAGE LANGUAGE GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	$\sigma_{\text{Diff.}}$	C.R.
22.44	0.732	4.58	39	3.28	0.94	3.489
M_2	σ_{m_2}	σ_2	N_2			
19.16	0.589	3.23	30			

The critical ratio of 3.489 is highly significant at the level selected at the outset of this study. A mean Minnesota Speed of Reading score of 22.44 \pm .732 is indicative of the student who was successful in the study of Languages in this group, while a mean score of 19.16 \pm .589 was a critical point about which the failing students were grouped.

Science Area.

Significance of the differences between the three test instruments for the high and the low achieving students revealed two significant critical ratios in the Science area.

Table 14
SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE
OTIS TEST WITH THE HIGH AND THE LOW AVERAGE SCIENCE GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	$\sigma_{\text{Diff.}}$	C.R.
124.84	0.796	3.09	15	14.97	0.91	16.45
M_2	σ_{m_2}	σ_2	N_2			
109.87	0.430	3.12	52			

The differences between the means of the high and the low average Science groups using the Otis Test as the distinguishing measure is highly significant with a C.R. of 16.45. Thus, a person obtaining a mean Otis I.Q. of 124.84 \pm .796 is the most successful student in this area, while one who obtains a mean Otis I.Q. of 109.87 \pm .431 finds himself in the non-successful group.

In the Science area an extremely significant critical ratio was obtained between the mean difference of the high and the low achieving groups using the A.C.E.

Table 15

SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE A.C.E. WITH THE HIGH AVERAGE AND THE LOW AVERAGE SCIENCE GROUPS, 1943-1946

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	σ Diff.	C.R.
139.30	0.649	2.52	15	28.00	0.70	40.00
M_2	σ_{m_2}	σ_2	N_2			
111.30	0.270	1.96	52			

The .26 per cent level at the outset of this study stated that a C.R. of 3.0 or above was to be considered significant. In light of this statement, this critical ratio of 40.00 between the differences of the means of the high and the low average Science groups is highly significant. The mean total score on the A.C.E. at which students are likely to succeed is 139.30 \pm .649 while the critical point at which most failing students are grouped

is at 111.30 £.270 in the Science area.

Table 16

SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE MINNESOTA SPEED OF READING TESTS WITH THE HIGH AND THE LOW AVERAGE SCIENCE GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	σ Diff.	C.R.
22.87	0.989	3.84	15	3.29	1.12	2.937
M_2	σ_{m_2}	σ_2	N_2			
19.58	0.518	3.59	48			

Although the critical ratio of 2.937, as found between the means of the high average and the low average Science groups on the basis of the Minnesota Speed of Reading Test is not considered significant at the .26 per cent level, it is a fairly high ratio of significance of the differences between the means of these two groups.

Mathematics Area.

Procedures to determine the significance of the differences between the high and the low achieving students in the Mathematics area using each of the three test measures revealed two extremely significant differences.

Table 17

SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE OTIS TEST WITH THE HIGH AND THE LOW AVERAGE MATHEMATICS GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	σ Diff.	C.R.
122.88	1.074	4.44	17	8.22	1.40	5.857
M_2	σ_{m_2}	σ_2	N_2			
114.66	0.905	4.62	26			

Students obtaining a mean Otis I.Q. of 122.88 \pm .1.074 are likely to be the more successful students in Mathematics than one who has a mean Otis I.Q. of 114.66 \pm .905 for the difference of 5.857 between these two groups is considered statistically significant.

Table 18
SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE A.C.E. WITH THE HIGH AND THE LOW AVERAGE MATHEMATICS GROUPS

M_1	σ_{m_1}	σ_1	N_1	$\text{Diff}_{M_1 - M_2}$	$\sigma_{\text{Diff.}}$	C.R.
132.10	0.830	3.43	17	10.20	1.21	8.429
M_2	σ_{m_2}	σ_2	N_2			
121.90	0.884	4.51	26			

The critical ratio of 8.429 using the A.C.E. was higher than the critical ratio found in this subject area using the Otis instrument, and statistically significant. Critical points of 132.10 \pm .830 and 121.90 \pm .884 are indicative of mean total levels on the A.C.E. above which and below which the high and the low achieving students are grouped.

Similar to the findings in the Science field is the critical ratio found in the Mathematics area using the Minnesota Speed of Reading Test.

Table 19

SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE MINNESOTA SPEED OF READING TEST WITH THE HIGH AND THE LOW AVERAGE MATHEMATICS GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	$\sigma_{\text{Diff.}}$	C.R.
22.65	0.874	3.61	17	3.06	1.35	2.266
M_2	σ_{m_2}	σ_2	N_2			
19.59	1.038	4.88	22			

The difference between the means over the standard error of the difference using the Minnesota Speed of Reading Test between the high and the low average Mathematics groups of 2.266 is not considered significant according to the level selected. Here it can be noted a greater error of the mean score for those obtaining grade scores of C- or below, or the chances that this is the true mean for this group with this instrument are less than is shown in other areas.

Fine Arts Area.

In the Fine Arts area all critical ratio findings using the three test measures are considered significant.

Table 20

SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE OTIS TEST WITH THE HIGH AND THE LOW ACHIEVING FINE ARTS GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	$\sigma_{\text{Diff.}}$	C.R.
121.20	0.819	4.42	29	12.88	1.11	11.603
M_2	σ_{m_2}	σ_2	N_2			
108.32	0.745	3.17	18			

In the Fine Arts area a critical ratio of 11.603 indicates significantly the extent of dissimilarity between the high and the low achieving groups using the Otis measure. The critical point above which succeeding students are grouped is a mean Otis I.Q. of $121.20 \pm .819$ and the level at which students obtain failing course marks is noted by a mean Otis I.Q. of $108.32 \pm .745$.

Highly significant is the critical ratio of 30.117 in the Fine Arts area using the A.C.E. as the discriminating measure.

Table 21
SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE A.C.E. WITH THE HIGH AND THE LOW AVERAGE FINE ARTS GROUP

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	$\sigma_{\text{Diff.}}$	C.R.
131.60	0.636	3.43	29	25.60	0.85	30.117
M_2	σ_{m_2}	σ_2	N_2			
106.00	0.557	2.37	18			

A mean A.C.E. total score of 106.00 $\pm .557$ is indicative of a level at which failing course marks of C- or lower are received, while a mean A.C.E. total score of 131.60 $\pm .636$ indicates a level at which these students receive higher course marks of B+ or better. The critical ratio of 30.117 is considered extremely significant.

Also considered significant is the finding between the high and the low achieving Fine Arts group using the Minnesota Speed of Reading Test.

Table 22
SIGNIFICANCE OF THE DIFFERENCES OF THE MEANS USING THE MINNESOTA SPEED OF READING TEST WITH THE HIGH AND THE LOW AVERAGE FINE ARTS GROUPS

M_1	σ_{m_1}	σ_1	N_1	Diff. $M_1 - M_2$	σ Diff.	C.R.
23.25	0.726	3.85	28			
M_2	σ_{m_2}	σ_2	N_2	4.21	1.01	4.168
19.04	0.701	2.72	15			

The critical ratio of 4.168 is considered a significant difference between the means of the Minnesota Speed of Reading Test of the high and the low average Fine Arts groups.

Summary

The group was graphically described in terms of sex and chronological age differentiation. Central tendencies and dispersions of the group for each of the three measuring instruments were computed and frequency polygons were made that a clearer picture of the homogeneity of the group may be seen.

Correlation studies, based upon the total grade point averages within a subject matter area with each of the three test measures were found. Seven of the correlation results ranging from +.423 to as high as +.542 were considered marked.

Since the withdrawal of a student during these years may have been due to many unknown reasons, a different method was employed to determine the significance of the

differences between the high and the low achieving students in each of six subject matter areas for each of the three test instruments. Critical ratios were found on the basis of division of the group into all those who achieved a grade point average of B+ or above and C- and below in each of the six subject matter areas.

Highly significant differences in sixteen areas were noted with two differences not being considered significant at the .26 per cent level selected.

CHAPTER IV

CORRELATIONS FOR PREDICTION

Correlation Findings

Predictability of the Olie Test.

One of the major goals in this study was to discover the degree of relationship between each of the three test instruments used and the grades earned in each of the six subject matter areas.

CHAPTER IV

The correlations between the Olie Test of Mental Ability in each of the six areas revealed but low significant correlations in the fields of Social Studies and Sciences. Relatively low correlations between the Olie and Geography, Mathematics, and English were found. Slightly higher, but not considered marked, was the "r" between Fine Arts and the Olie test.

The implication from these findings would lead to dis-mourning the use of the Olie test as a single predictive measure for success in college, except in the fields of Science and Social Studies. With this, these correlation findings indicate insufficient evidence upon which to base such a decision. Limitations as to the limited sample population obtained during four years, and the degree of validity of the terms in these areas must be considered.

Predictability of the Olie.

Peculiar to the reported findings, only two significant

CHAPTER IV

IMPLICATIONS FOR PROGNOSIS

Correlation Findings

Predictability of the Otis Instrument.

One of the major areas in this study was to discover the degree of relationship between each of the three test instruments used and the grade averages in each of the six subject matter areas.

The correlations between the Otis Test of Mental Ability in each of the six areas revealed but two significant correlations in the fields of Social Studies and Science. Relatively low correlations between the Otis and Language, Mathematics, and English were found. Slightly higher, but not considered marked, was the "r" between Fine Arts and the Otis test.

The implication from these findings would lead to discouraging the use of the Otis test as a single predictive measure for success in college, except in the fields of Science and Social Studies. Even then, these correlation findings indicate insufficient evidence upon which to base such a decision. Limitations as to the biased sample population obtained during war years, and the degree of reliability of the marks in these areas must be considered.

Predictability of the A.C.E.

Peculiar to the reported findings, only two significant

correlations between the A.C.E. and the grade averages were noted; the correlation of $.501$ with Social Studies, and the correlation of $.442$ with Science. It should be noted that two of the correlations in the other four subject areas are higher than with the Otis instrument, but not considered significantly greater in this study.

The higher correlations secured on the A.C.E. with the grade averages are in the same two subject areas as were the high correlations with the Otis instrument. This might be explained by the greater degree of objectivity of marking within these two areas, or, the greater predictability of these instruments in these two fields.

Evidently factors operating in these two measures are also found to operate in these two subject areas. Comparison with other findings in this respect is difficult, since reported correlations deal mainly with semester averages.

Predictability of the Minnesota Speed of Reading Test.

Significant correlations between this measure and three subject areas were found. The relationship between the Minnesota Reading Test and English was $.542$, Minnesota and Language, $.423$, and the Minnesota and Science, $.452$. With the exception of Mathematics, the other two correlations were found to be significant to a lesser degree. This would imply that the speed factor in reading has a more direct relationship to success in the areas of English, Language, and

Science to a greater degree than in the areas of Social Studies, Mathematics, and Fine Arts.

Implications From the Correlation Study.

It is to be noted that the correlations between the Science grade point averages and each of the three test instruments were significant.

It is not so difficult to explain the low nature of many of the correlations between grade scores in the six subject areas and the three separate test instruments. It has often been assumed that students exhibiting average or above average scores on a scholastic aptitude instrument would also obtain average or above average grades in a course. However, the personality factors, perseverance, interest characteristics, physical well-being, study-habits, which are not measured, may operate to determine a higher or lower course grade than would be anticipated solely on the basis of the intelligence and the speed of reading factors separately. At the same time a low "r" might result when the reliability of the marking system is not high, due to a lack of objective measurement. Another factor that predetermines, to some extent, a low correlation is the homogeneity of the group which has been pointed out previously.

It would be extremely hazardous to use any one of these three instruments for the sole basis of prognosis of success in any given area. The relatively low nature of the majority

of correlations found indicates the single use of any of these three measuring instruments is not a reliable means of predicting a student's success in college. It is necessary to look at the high school averages and all of the information that can be obtained in the student's background, personality, physical well-being, as well as test scores in guiding students on the college level.

These findings should be viewed in light of the somewhat biased sample resulting from a study of one class entering Boston University during war years.

Intercorrelations Between Test Measures.

The question is raised whether different instruments predicting scholastic achievement might not be measuring different factors. The degree to which a high similarity of function is maintained between such measures is evidenced by the correlation between these instruments.

In this study of the degree of relationship between the Otis Test of Mental Ability and the A.C.E. was found in a correlation of $.652$. The nature of this result does not make it possible to say that these two instruments are measuring the same elements. There is some agreement as to the factors of scholastic aptitude which each instrument measures, but it is not marked nor identical by any means. It is evident that these two instruments are not measuring the same

thing so that one score could not be used to predict the other.

Since the Otis Test of Mental Ability is a verbal test in which the speed factor is important, it might be expected that a high degree of relationship between this instrument and the Minnesota Speed of Reading Test would exist. The results indicate a correlation of $.432$ which is, for practical purposes, stating that factors operating in the Minnesota Reading Test are also operating somewhat in the Otis Test, but not to a marked degree.

Similarly, the findings between the A.C.E. and the Minnesota Speed of Reading Test revealed a positive correlation of $.394$, which indicates about the same relationship as was found between the Otis and the Minnesota Reading instrument.

Negative correlation values of $-.19$ and $-.233$ between chronological ages and the A.C.E. and between the Minnesota Speed of Reading Test respectively, were found. A $-.09$ correlation between the Otis I.Q. and the chronological ages also revealed no significant relationship between a person's age, but the trend was positive. These insignificant correlations are in keeping with the expectancy.

Critical Ratio Findings

The second major area in this study was to determine the significance of any differences between the high achieving and the low achieving students in each of the six subject areas for each of the three measuring instruments used. Charts

of specific findings were discussed in Chapter III, but for ease in interpreting and comparing the total findings, a summary table is included below.

Table 23

CRITICAL RATIOS FOUND ON DIFFERENCES BETWEEN THE HIGH ACHIEVING AND THE LOW ACHIEVING STUDENTS IN EACH OF THE SIX SUBJECT AREAS FOR EACH OF THE THREE TEST INSTRUMENTS

Subject Area	Otis	A.C.E.	Minn.
English	14.859	27.46	3.932
Social Studies	10.838	45.94	3.914
Language	8.25	30.04	3.489
Science	16.45	40.00	2.937
Mathematics	5.857	8.429	2.266
Fine Arts	11.603	30.117	4.168

The .26 per cent level, or a Critical Ratio of 3.0, was selected at the outset of this study for purposes of evaluating the results. By inspection, it can be seen that 16 of the critical ratios found are to be considered highly significant, and two results which are not considered significant at the level selected.

The differences between the high achieving groups, B+ or above average students, and the low achieving groups, C- or below average students, in each subject area for the Otis instrument are all significant.

The high achieving group of students were found to have a mean Otis I.Q. of 121.68 and the low achieving group, in contrast, were found to have a mean Otis I.Q. of 111.23.

Thus, it can be noted for this group in this type of college that pupils getting a very high score on the Otis are more apt

to be the high achieving students and that those who obtained a low score on the Otis are more likely to fall in the low achieving groups.

In all cases the A.C.E. did a better job of discriminating between these two groups of students. These findings indicate the American Council Psychological Examination is a more usable instrument for predicting a critical score above which groups succeed and below which many tend to fail or receive low marks. The high achieving group of students were found to have a mean total score of 127.02, while the low achieving students obtained a mean total score of 112.36 on this instrument.

Four very significant differences can be observed in the areas of English, Social Studies, Language, and Fine Arts using the Minnesota Speed of Reading Test. In the areas of Science and Mathematics those students achieving higher average marks are somewhat different in their ability to read rapidly than students achieving low average marks, but not different to the significant level selected in this study. Evidently the rate of reading is not as differential a factor between academic success in the Science and Mathematics areas as it is in the other fields.

Viewing these findings using the Minnesota Speed of Reading instrument as compared with the Otis and the A.C.E. measures, it is to be noted that considerably smaller critical

ratios occur with the Speed of Reading Test. It may be inferred that the rate of reading is not as strong a differentiating factor in academic achievement in college as is academic aptitude.

Summary.

The generally low nature of a majority of the correlation findings restricts the use of these instruments in this institution. In this study, the correlation results would not indicate that either the Otis Test of Mental Ability or the American Council Psychological Examination were sufficiently high to warrant their use for prognostic purposes. Evidently the reading rate does have some influence on scholastic achievement, but not with equal effectiveness in all areas. The speed of Reading Test did not differentiate as significantly as did the academic aptitude tests between the best and the poorest students.

Each of the two measures of scholastic aptitude do appear to differentiate significantly between the two extreme groups of the high and the low achieving students, but the A.C.E. seems to discriminate between them to a greater degree than the Otis Test of Mental Ability. However, the correlation findings indicate these measures do not give the position these groups will occupy within the total college population.

CHAPTER V
LIMITATIONS OF THIS STUDY AND THE NEED
FOR FURTHER RESEARCH

Like most studies in predicting academic achievement, this one raises many questions which it is impossible to answer without further research. Since this study used derived data from the Counseling Department, rather than a planned experiment, certain limitations are inherent in the study. The following inadequacies are to be noted:

CHAPTER V

1. The population sample on which this study is based is atypical in the respect that a highly biased sex distribution is evident. Consideration must be given to the fact that this group enrolled in 1960 when many young men, who might have entered this college, were required to enter military service.

2. Complete data was not always available. That is, some students did not take all or the basic administered, and information regarding withdrawn students was incomplete.

3. Meaningful comparisons between correlations or other investigations could not be made since the majority of other studies based correlations findings on first semester total averages, for the test instruments used in this study.

4. Evaluation of the critical ratio findings in light of other research was impossible, since statistics made of discriminations between the high and the low achieving groups did not use this process.

5. It would be unfair to argue from the findings of any one study of any one college group to the general College population. This is due to the widely existing variations in course content, methods of instruction, and grading standards of learning between institutions; but the main value lies in the use of the findings within this group for this particular college.

Problems Suggested for Further Study.**CHAPTER V****LIMITATIONS OF THIS STUDY AND THE NEED
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2. Complete data was not always available. That is, some students did not take all of the tests administered, and information regarding withdrawal students was incomplete.
3. Meaningful comparisons between correlations of other investigations could not be made since the majority of other studies based correlations findings on first semester total averages, for the test instruments used in this study.
4. Evaluation of the Critical Ratio findings in light of other research was impossible, since studies made of differentiations between the high and the low achieving groups did not use this process.
5. It would be unfair to argue from the findings of any one study of any one college group to the general College population. This is due to the widely existing variations in course content, methods of instruction, and existing standards of marking between institutions; but its main value lies in the use of the findings within this group for this particular college.

Problems Suggested For Further Study.

1. Does any meaningful relationship between the marks received by the present entering freshmen and the test measures exist? Which test instruments now used seems to show a higher degree of relationship with course marks? In which subject area? Will this group, a post-war college population, show a different degree of relationship than the findings in this study indicate?
2. Is there a noticeable difference on the basis of sex discrimination, using different measures?
3. With a normal college population sample, what relationship is there between the two major sub-tests of the A.C.E. and grade scores in each of the six subject areas?
4. If it is possible, a study of the weighted values of the different Professor's marks in each section of each Department may result in more meaningful correlation coefficients. What objective measures of achievement and standards for marking are used by the different readers, assistants, and Professors in a Department?
5. What aspects of scholastic aptitude are most needed for success in college?
6. If more complete information regarding the withdrawal student, reasons for leaving and complete grade scores up to the time he left, were available, various studies might ensue:
 - a. What is the relationship between grades received by the withdrawal student and his general scholastic aptitude tests?
 - b. Does the withdrawal student significantly differ from the student who remains in school on the basis of course marks? scholastic aptitude? personality test scores? participation in extra-curricula activities?
7. Further exploration of the differences that may exist between students who remain in school and those who drop-out, in our post-war population, would be of value. Is the student who drops out really a different kind of student than the one who remains in college? If so, in what respects is he different?
8. What is the influence of personality on academic success in college?

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THE GAMMA MENTAL ADULT TEST

(A Test for General Intelligence and Special Mental Abilities)

MANUAL OF DIRECTIONS FOR GAMMA TEST FORMS AM AND BM

Forms AM and BM are the two forms of the Gamma Test. They are identical in content, except that the Stimulus Cards are different. Form AM contains 100 cards, while Form BM contains 100 cards.

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APPENDIX

This Test consists entirely of picture tests. There are two kinds of picture tests—(1) those used in the administration of the Gamma Test, and (2) those used in the administration of the Gamma Test, and (3) those used in the administration of the Gamma Test.

Gamma Test Pictures

The pictures used in the administration of the Gamma Test consist of three kinds of pictures—(1) those used in the administration of the Gamma Test, and (2) those used in the administration of the Gamma Test.

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Appendix A contains the pictures used in the administration of the Gamma Test. Appendix B contains the pictures used in the administration of the Gamma Test. Appendix C contains the pictures used in the administration of the Gamma Test. Appendix D contains the pictures used in the administration of the Gamma Test.

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Administration Pictures

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Administration Test

Procedure is made in Forms AM and BM to insure greater than the greatest of expected accuracy.

RECOMMENDATION

OTIS QUICK-SCORING MENTAL ABILITY TESTS

By ARTHUR S. OTIS, PH.D.

Formerly Development Specialist with Advisory Board, General Staff, United States War Department

MANUAL OF DIRECTIONS FOR GAMMA TEST FORMS AM AND BM

THE QUICK-SCORING SERIES

The Otis Quick-Scoring Mental Ability Tests comprise three tests, called Alpha, Beta, and Gamma. The three tests are designed for grades as follows:

Alpha Test.....Grades 1-4

Beta Test.....Grades 4-9

Gamma Test...High Schools and Colleges

The Alpha Test consists entirely of pictures and is completely new. The Beta and Gamma Tests are revisions and extensions of the Intermediate and Higher Examinations, respectively, of the Otis Self-Administering Tests of Mental Ability.

PURPOSE OF THE TESTS

The purpose of the three tests in the series is to measure mental ability — thinking power or the degree of maturity of the mind.

It should be understood from the outset that it is not possible to measure mental ability directly. It is possible only to measure the effect mental ability has had in enabling the pupil to acquire certain knowledge and mental skill. Of course the answering of some types of questions depends less upon schooling and more upon mental ability than the answering of others, and in making up the test the aim has been for the most part to choose that kind of question which depends as little as possible on schooling and as much as possible on thinking.

However, in the interest of variety it has been found necessary and even advantageous to include in verbal tests of mental ability such as the Beta and Gamma Tests certain questions which might seem at first glance to be mere measures of achievement. This type includes questions on vocabulary, arithmetic reasoning, etc. It must be remembered, however, that any test which involves the use of language can measure mental ability only to the extent to which we may assume that pupils of the same age have had approximately the same

opportunity to learn. Consequently, if a pupil has grown up with a limited educational opportunity, especially with reference to language, his mental ability is not fairly measured by any test involving language. But in a given community in which all children have approximately the same educational opportunity, it is reasonable to assume that a pupil who progresses rapidly in school and learns much has greater mental ability for his age than one who progresses less rapidly and learns less. To this extent, therefore, certain achievement questions such as vocabulary and arithmetic reasoning questions, even though depending on language, do measure mental ability.

ALTERNATIVE FORMS

There are four forms of the Gamma Test (Forms AM, BM, C, and D), similar in construction but differing in content. Forms C and D are published in a smaller size with a special folding, as in Beta Test: Forms A and B.

SPECIAL FEATURES

The tests are self-administering in the same sense as the Otis Self-Administering Tests of Mental Ability, in that it is necessary merely to pass out the booklets, allow the pupils time to study the first page with a minimum of directions, and then let them go ahead and take the test. A single examiner may administer the tests to all the classes of a moderate-sized school in a day, by devoting a few minutes to start one class taking the test, leaving the class in care of the teacher, and going on to the next class, etc. This is a good way to assure reasonable uniformity of procedure in the giving of the tests.

In addition to the ease of administration which these tests afford by virtue of their single time limit, a new method of stencil scoring is provided by which the tests may be scored even more rapidly than the Self-Administering Tests.

Provision is made in Forms AM and BM for the pupil to put his answers to all the questions on one sheet, called the Answer Sheet, which is page 2 of the test booklet. To

use the Answer Sheet, the pupil tears it off from the rest of the booklet and slips it under the booklet in such a way that the spaces for the answers appear just to the right of the test page.

A row of 5 spaces like this 1 2 3 4 5 on the Answer Sheet corresponds to each question. The spaces are numbered consecutively and arranged so as to align perfectly with the questions on the test paper in order to make sure the pupil will not put his answer mark in the wrong row of spaces.

To indicate his answer to a question, the pupil makes a vertical mark in the space that has the same number

as the answer he has chosen, like this: 1 2 3 4 5

The Answer Sheet is then scored by a stencil key containing holes so spaced that if the pupil has put his mark in the right space it will show through the hole in the Key; otherwise not. To score the paper, it is necessary merely to count the marks that can be seen through the holes in the Key. One application of the Key is sufficient, of course, to score the whole test.

Experience shows that this is the quickest possible method of scoring a test "by hand," so to speak. Its principal advantage is that the scorer does not have to look at each answer to see whether a cross is in or not in a given square or circle — he disregards all wrong answers completely and merely counts right ones.

It is by reason of this new scoring feature that the tests are called "Quick-Scoring Tests."

MACHINE SCORING

Forms AM and BM of the Gamma Test may be scored also by the International Business Machines Corporation scoring machine. For this purpose a special extra Answer Sheet must be used. It is used in the same way as the attached Answer Sheet but has to be printed separately. It is also sold separately.

Further information about machine scoring of these tests may be had by addressing World Book Company.

DIRECTIONS FOR ADMINISTERING

To administer Form AM or BM of the Gamma Test, address the pupils as follows: (Give all directions slowly and distinctly, with a pause after each sentence.)

"We are now going to give you some tests that measure your ability to think. I will pass out the test papers and as soon as you receive one, read the first page and do what it tells you to do; that is, fill the blanks, giving your name, age, etc., and answer the sample questions.

"Do not open or turn over the booklet. Part of the test is to see if you can follow directions."

Have the test papers passed, one to each pupil, right side up; that is, with the title page up. If separate Answer Sheets are to be used, pass these out also. See that every pupil is supplied with two pencils and an eraser. It is better not to have the pencils too sharp, principally because it is better to have the pupils make wide marks, since these are easy to see.

Allow a reasonable time for all to finish reading the first page; then say: "Is there anyone who does not understand how to answer the samples?" Be sure all do.

If the attached Answer Sheet is to be used, read the first indented paragraph below and skip the second.

If the machine-scoring Answer Sheet is to be used, skip the first indented paragraph and read the second.

(Attached Answer Sheet)

"Now turn to page 2, which is the Answer Sheet. You are to put your marks in the spaces on this Answer Sheet. Tear off the Answer Sheet."

(Machine-Scoring Answer Sheet)

"Now notice the separate Answer Sheet that has been passed to you. You are to put your marks in the spaces on this Answer Sheet.

(Continue here.)

"Slip the Answer Sheet under the edge of page 3 so that the column of spaces marked 'Page 3' is alongside of page 3 like this." (Show by holding up page 3 with the "Page 3" column of the Answer Sheet close to page 3 of the booklet.) "Notice that the arrow tips on the Answer Sheet point directly toward the arrow tips on page 3. In answering the first question, you put a mark in one of the spaces in the first row, and so on.

"When you finish page 3, pull out the Answer Sheet a little way like this," (Show.) "so that you can see the column of answers for page 4, and do page 4. Always keep the Answer Sheet shoved under the booklet so that the column of the Answer Sheet on which you are working is close to the test paper.

"When you come to page 5, fold page 6 under like this," (Show how.) "so that you can get the 'Page 5' column of the Answer Sheet close to page 5 of the booklet like this." (Show.)

"Never put more than one mark in any row of spaces.

"Is there anyone who does not understand what to do?" (Answer any questions about how to take the test.) Then say:

"As explained in the paragraph below the samples, the test contains eighty questions. You are not expected to be able to answer all of them, but do the best you can. You will be allowed a half hour. Try to get as many

right as possible. Be careful not to go so fast that you make mistakes. Do not spend too much time on any one question. No questions about the test will be answered after the test begins.

"Now go ahead and answer the questions. Remember to make heavy black marks."

Write immediately on the blackboard the exact time when the pupils begin to take the test. It is helpful to write on the blackboard also the time the pupils must stop work. Thus, if pupils are started at 1:17, write this on the blackboard and under it write 1:47. Or set your watch exactly on the hour and when it is exactly half-past the hour by your watch, the time will be up.

It should be understood by the examiner that no questions about the test are to be answered which might give the pupils the slightest help in answering the questions; that is, the examiner or teacher may not explain the meaning of any word or give any hints. It is permissible at the beginning of the examination for the examiner to move quietly about the room to make sure that the pupils are indicating their answers in the proper manner (making heavy black marks), and if during the examination a pupil becomes confused on account of the use of the separate Answer Sheet, it is permissible, of course, to explain to him how to proceed. Thereafter it is better for the teacher to remain seated at her desk so that the room is quiet and the pupils may work undisturbed.

The one in charge of timing the test should be particularly impressed with the need to watch the time carefully, for it is very easy to forget the time and let the pupils work more than the time allowed.

When the stopping time is reached, say: "Stop! Lay your pencil down."

Have the Answer Sheets collected. Then have the pupils write their names at the top of page 3 of the booklet. Then have the booklets collected. The booklets should be preserved until after the scoring of Answer Sheets is done; then they may be destroyed.

DIRECTIONS FOR SCORING

A Key for scoring the test is included in each package of tests.

To score an Answer Sheet, lay the Key over the Answer Sheet in such a way that the heavy circles which are printed with crosses in them at the top of the test appear through the appropriate holes at the top of the Key. The Key will then be adjusted so that all the marks that the pupils have made in the right spaces will show through the holes.¹ The number of marks so

appearing is the pupil's score. This should be written in the space provided at the top of the title page.

The pupils have been instructed to be sure not to put more than one mark in any row of spaces. However, if in the case of any item two marks have been put in the same row of spaces, no credit is given for that item.

Ordinarily in scoring this test there is no need to mark the answers right or wrong but merely to count them, for only the total score is of significance. To avoid errors in counting, after the numbers right have been counted, continue the count with the wrong and omitted items and make sure that you end with 80.

In the interest of accuracy it is well for each Answer Sheet to be scored independently by two persons. If this is done, the score obtained by the first scorer may be written at the foot of the page. Then, after the next scorer has scored the paper and compared his count with that made by the first scorer and found it to check, the sheet may be turned and the checked score written on the title page.

DIRECTIONS FOR RECORDING SCORES

In each package of tests there is included a Class Record which provides for the recording of scores of a class.

Before entering the scores, arrange the papers either in alphabetical order or in order of magnitude of score, according to preference. Then enter the name of each pupil, his age in years and months, and his score.

Note that provision is made on the Class Record for entering later the IQ of the pupil and any additional data, such as percentile rank in the class or school, classification designation, etc., and for entering the median age, median score, etc., if desired.

Provision is made at the foot of page 2 of the Class Record for distributing the scores of a class or a school. To distribute the scores of a class, make a mark in the second column of the table for each pupil's score, putting the mark opposite the interval within which the score falls. Thus, if the first pupil has made a score of 63, put a mark opposite 60-64. Draw each fifth mark across the preceding four like this,  This makes it easier to count the marks.

After the marks are all entered, count those in each interval and write the number in the column headed "Freq." (Frequency).

To find the median (middle) score, count from either end of the distribution to the middle mark. If the middle mark falls, say, in the interval 50-54, sort out the papers whose scores fall in this interval, and, if the median is the third mark in the interval, find the score

¹ The arrangement for scoring this test is covered by Patent No. 1,586,628, originally taken out by Charles E. Lauterbach.

on the third paper in that bunch of papers. That score is the median score of the class. (See Chapter II of Otis: *Statistical Method in Educational Measurement*,¹ or a similar text, for detailed explanations of other methods for finding the median.)

REPORTING TO THE AUTHOR

To assist in making the norms more comprehensive, the author would appreciate the favor of receiving from each school system using 100 tests or more the following data for each grade:

Test used (Gamma)	Median Age (when each age has been recorded in years and months)
Form used (AM or BM)	
Grade	
Date of the test	Median Score

That is, the author wishes to know the median age in years and months and the median score of all the pupils in the school system who are in the ninth grade, the same for all who are in the tenth grade, etc., whatever grades were tested. Address Dr. Arthur S. Otis, care of World Book Company, Yonkers, New York. This courtesy will be appreciated.

NORMS

If a large number of 15-year pupils take a test and their scores are arranged in order, the median or middle score is considered as just normal for 15-year pupils and is said to be the *norm* for the age of 15 years.

Table 1 gives the norms for the various ages of pupils taking Gamma. The table is read as follows: The norm for the age of 11 years 0 months is a score of 20, etc. The norm for adults is 42.

TABLE 1

NORMS IN THE GAMMA TEST, FORMS AM AND BM

YEARS →	11	12	13	14	15	16	17	18 or over
0	20	25	29	33	37	39	41	42
1	21	26	30	34	37	40	41	
2	21	26	30	34	37	40	41	
3	22	26	30	34	38	40	41	
4	22	27	31	35	38	40	41	
5	22	27	31	35	38	40	41	
6	23	27	31	35	38	40	42	
7	23	28	32	36	38	41	42	
8	23	28	32	36	39	41	42	
9	24	28	32	36	39	41	42	
10	24	29	33	36	39	41	42	
11	25	29	33	37	39	41	42	

¹ Published by World Book Company.

The norms for Gamma were obtained in part by means of equating experiments in which 777 pupils took Gamma and the Otis Higher Examination, 742 pupils took Gamma and Beta, and 1661 pupils took Gamma and the Pintner Advanced General Ability Test.

INTELLIGENCE QUOTIENTS

A measure of a pupil's brightness, called an Intelligence Quotient (IQ), is sometimes found by dividing the pupil's Mental Age by the Binet Scale by his "Chronological Age."

A measure of brightness of a pupil comparable to an intelligence quotient (IQ) obtained by the Binet Scale may be found by comparing his score in the Gamma Test with the norm for his age, as explained below. A measure so found is not a quotient, but it is called an "IQ" because it has the same significance as an IQ.

HOW TO FIND A PUPIL'S "GAMMA IQ"

To find a pupil's "Gamma IQ" proceed as follows:

- Find the norm for the pupil's age from Table 1.
- Find the amount by which the pupil's score exceeds (or falls below) the norm for his age. Call this his "deviation of score."
- Add the pupil's deviation of score to 100 (or subtract from 100 if the deviation is downward). The result is the pupil's "Gamma IQ."

For example, suppose a pupil of the age of 14 years 6 months makes a score of 45. The norm for 14 years 6 months in Table 1 is 35 points. The pupil's score of 45 points exceeds his norm of 35 by 10 points. Hence his "Gamma IQ" is $100 + 10$, or 110.

"Gamma IQ's" found by this method tend to be somewhat less variable than ordinary IQ's; that is, they tend to be somewhat nearer to 100. This fact should be borne in mind if comparisons are made between "Gamma IQ's," found as above, and ordinary IQ's, found by the division method.

VALIDITY AND RELIABILITY OF THE TEST

The method by which the items of the Higher Examination (used in Gamma) were originally validated is described in the Manual for the Otis Self-Administering Tests of Mental Ability.

In an article in the *Journal of Experimental Education* for March, 1937, Alphonse Chapanis, of Connecticut State College, describes an experiment in which the validity of each item of the Higher Examination was investigated by finding the biserial coefficient of correlation between the item and the total score in the test. Although the scores of only 100 adults of each sex were used in the experiment, the coefficients for the items

were without exception positive for both sexes, having a median value of + .61. This experiment indicates that all the items of the Higher Examination have real validity in a mental ability test.

The correlation between the Gamma Test and the Higher Examination was found for the 1007 pupils tested in Yonkers, New York. The coefficients were as shown in Table 2.

TABLE 2

COEFFICIENTS OF CORRELATIONS BETWEEN GAMMA AND HIGHER EXAMINATION

GRADE	10	11	12	AVERAGE
Gamma A 1st — Higher Exam. 2d	.89	.86	.82	
Gamma A 2d — Higher Exam. 1st	.86	.88	.82	
				.86
Gamma B 1st — Higher Exam. 2d	.87	.85	.92	
Gamma B 2d — Higher Exam. 1st	.84	.80	.88	
Average number of pupils per coefficient = 84				

The reliability of the Gamma Test was investigated by correlating the odd-numbered and even-numbered items of the test papers of 257 pupils in Grades 10, 11, and 12. The coefficients so found were, respectively, .82, .85, and .73 for the three grades. When corrected by the Spearman-Brown formula, the reliability coefficients for the three grades were found to be .90, .91, and .85, respectively.

APPLICATION OF RESULTS

Purposes of mental ability tests. The principal purposes for which mental tests are given are these:

1. For teaching purposes, to discover which pupils are bright and capable of doing better school work than they are doing and to discover which pupils are dull and may be attempting work beyond their capacity.

2. For administrative purposes, to regrade pupils so that the pupils in any one grade will be more homogeneous in mental ability and therefore able to progress at more nearly the same rate than otherwise.

3. For administrative purposes, to classify pupils into separate groups within grades in order that the brighter or the more mature pupils may be given an enriched curriculum and in order that the duller or the less mature pupils may be allowed to progress at a slower rate.

Such classifying is sometimes done on the basis of score (dividing the pupils on the basis of mental maturity)

and sometimes on the basis of IQ (dividing the pupils on the basis of brightness). The first of these methods is recommended.

4. For research purposes, to obtain two or more groups of equal mental ability or brightness which may be given different methods of instruction for the purpose of determining which method is superior.

5. For guidance purposes, to assist pupils to choose wisely in planning their educational, recreational, and vocational programs.

6. For administrative purposes, to determine the comparative mental status of pupils of different schools or localities.

Distributing scores. For any one of the purposes mentioned above it is desirable to distribute the scores of a class. This is usually done by finding the intervals 0-4, 5-9, etc., into which the scores fall. Provision is made for so distributing the scores of a class on the Class Record, a copy of which is enclosed in each package of tests.

Classifying pupils according to score. If desired to divide the pupils of a grade into classes according to score, the scores of all the pupils of the grade may be entered in one distribution on a Class Record or the test papers may be arranged in order of score. The scores may then be divided into an upper third, middle third, and lower third, or in any other convenient way, and the pupils classified accordingly.

It will be found that pupils so grouped are much more alike in their ability to learn than the pupils of the whole group and can be taught together much more easily.

ACKNOWLEDGMENTS

Thanks are due to A. L. Maxon, Director of Research, Department of Public Instruction, Schenectady, New York, to Lloyd N. Morrisett, Director of Secondary Education in Yonkers, New York, to Frank L. Baker, Principal of the Yonkers High School, and to Arthur Bibbins of the Darien, Connecticut, Public Schools for kind co-operation in the equating experiments. Thanks are due also to J. Henry Highsmith of the Division of Instructional Service, North Carolina, and to C. Everett Myers, Supervisor of Research, State Department of Education, Virginia, for providing distributions of scores for large numbers of cases.



OTIS QUICK-SCORING MENTAL ABILITY TESTS

By ARTHUR S. OTIS, PH.D.

Formerly Development Specialist with Advisory Board, General Staff, United States War Department

Gamma
AM

GAMMA TEST: FORM AM

IQ.....

For Senior High Schools and Colleges

Score.....

Read this page. Do what it tells you to do.

Do not open this booklet, or turn it over, until you are told to do so.

Fill these blanks, giving your name, age, birthday, etc. Write plainly.

Name..... Age last birthday years
First-name, initial, and last name

Birthday..... Teacher..... Date..... 19.....
Month Day

Grade..... School..... City.....

This is a test to see how well you can think. It contains questions of different kinds. Here are three sample questions. Five answers are given under each question. Read each question and decide which of the five answers below it is the right answer.

Sample a: Which one of the five things below is soft?

① glass ② stone ③ cotton ④ iron ⑤ ice..... 1 2 3 4 5

The right answer, of course, is *cotton*; so the word *cotton* is underlined. And the word *cotton* is No. 3; so a heavy mark has been put in the space under the 3 at the right. This is the way you are to answer the questions.

Try the next sample question yourself. Do not write the answer; just draw a line under it and then put a heavy mark in the space under the right number.

Sample b: A robin is a kind of —

⑥ plant ⑦ bird ⑧ worm ⑨ fish ⑩ flower..... 6 7 8 9 10

The answer is *bird*; so you should have drawn a line under the word *bird*, and *bird* is No. 7; so you should have put a heavy mark in the space under the 7. Try this one:

Sample c: Which one of the five numbers below is larger than 55?

⑪ 53 ⑫ 48 ⑬ 29 ⑭ 57 ⑮ 16..... 11 12 13 14 15

The answer, of course, is 57; so you should have drawn a line under 57, and that is No. 14; so you should have put a heavy mark in the space under the 14.

The test contains 80 questions. You are not expected to be able to answer all of them, but do the best you can. You will be allowed half an hour after the examiner tells you to begin. Try to get as many right as possible. Be careful not to go so fast that you make mistakes. Do not spend too much time on any one question. No questions about the test will be answered by the examiner after the test begins. Lay your pencil down.

Do not turn this booklet until you are told to begin.

Patent No. 1,586,628

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PRINTED IN U.S.A. GAMMA : AM-23

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ANSWER SHEET

Otis Quick-Scoring : Gamma : AM

Page 6

⊕	66	67	68	69	70
64	71	72	73	74	75
65	76	77	78	79	80
66	77	78	79	80	

←	1	2	3	4	5
67	81	82	83	84	85
*	49	50	51	52	53
68	86	87	88	89	

6	7	8	9	10	
69	11	12	13	14	
70	16	17	18	19	
71	21	22	23	24	
72	26	27	28	29	
	31	32	33	34	

21	22	23	24	25
71	51	52	53	54
72	56	57	58	59
	60	61	62	63
	64	65	66	67

31	32	33	34			
73	21	22	23	24		
	26	27	28	29		
74	31	32	33	34		
75	36	37	38			
	41	42	43	44		
76	57	58	59	60		
	61	62	63	64		
77	66	67	68	69	70	
	71	72	73	74	75	
78	76	77	78	79	80	
	81	82	83	84	85	
79	86	87	88	89	90	
	91	92	93	94	95	
80	96	97	98	99	100	

56	57	58	59	60
78	51	52	53	54
	59	60	61	62
79	61	62	63	64
	66	67	68	69
80	61	62	63	64
	66	67	68	69

Page 5

66	67	68	69	70
46	71	72	73	74
47	76	77	78	79
48	76	77	78	79
	81	82	83	84

81	82	83	84	85
49	86	87	88	89
50	86	87	88	89
	91	92	93	94

1	2	3			
69	51	52	53	54	
70	6	7	8	9	
71	11	12	13	14	
72	16	17	18	19	
	21	22	23	24	

16	17	18	19	20	
54	16	17	18	19	
	21	22	23	24	

21	22	23	24	25
55	26	27	28	29
56	31	32	33	34
	39	40	41	42

36	37	38		
74	31	32	33	34
75	36	37	38	
	41	42	43	44
76	57	58	59	60
	61	62	63	64

36	37	38	39	40
58	41	42	43	44
59	31	32	33	34
	39	40	41	42

36	37	38	39	40
58	41	42	43	44
59	31	32	33	34
	39	40	41	42

36	37	38	39	40
60	46	47	48	49
	41	42	43	44
77	46	47	48	49
	46	47	48	49

51	52	53	54	
61	51	52	53	
	56	57	58	
79	61	62	63	
	66	67	68	

56	57	58	59	60
62	61	62	63	64
	66	67	68	
80	61	62	63	
	66	67	68	

63				

Page 4

26	27	28	29	30
22	31	32	33	34
23	36	37	38	39
24	41	42	43	
	46	47	48	

41	42	43		
25	61	62	63	
26	51	52	53	
27	65	66	67	
	71	72	73	

46	47	48	49	50
60	46	47	48	49
	41	42	43	44
77	46	47	48	49
	46	47	48	49

1	2	3	4	
33	6	7	8	
34	9	10		
35	11	12	13	
36	14			

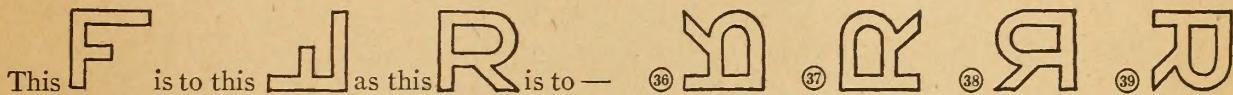
21	22	23		
22	23	24		
23	25			
24	26			
25	27			

26	27	28	29	30
38	31	32	33	34
39	36	37	38	39
40	36	37	38	39
41	36	37	38	39

46	47	48	49	50

<

1. The opposite of hate is—
 (1) enemy (2) fear (3) love (4) friend (5) joy
2. If 2 pencils cost 5 cents, how many pencils can be bought for 50 cents?
 (6) 100 (7) 10 (8) 20 (9) 25 (10) 5
3. A dog does not always have—
 (11) eyes (12) bones (13) a nose (14) a collar (15) lungs
4. A recollection that is indefinite and uncertain may be said to be—
 (16) forgotten (17) secure (18) vague (19) imminent (20) fond
5. Which of these words would come first in the dictionary?
 (21) more (22) pile (23) mist (24) pick (25) mine
6. A fox most resembles a—
 (26) pig (27) goat (28) wolf (29) tiger (30) cat
7. Gold is more costly than silver because it is—
 (31) heavier (32) scarcer (33) yellower (34) harder (35) prettier
8. The first drawing below is related to the second in the same way that the third one is to
one of the remaining four. Which one? →



This **F** is to this **J** as this **R** is to— **36** **Y** **37** **C** **38** **R** **39** **T**

9. A radio is related to a telephone in the same way that (?) is to a railroad train.
 (41) a highway (42) an airplane (43) gasoline (44) speed (45) noise
10. The opposite of wasteful is—
 (46) wealthy (47) quiet (48) stingy (49) economical (50) extravagant
11. A debate always involves—
 (51) an audience (52) judges (53) a prize (54) a controversy (55) an auditorium

12. A party consisted of a man and his wife, his two sons and their wives, and four children
in each son's family. How many were there in the party?

56 7 **57** 8 **58** 12 **59** 13 **60** 14

13. One number is wrong in the following series.

1 5 2 6 3 7 4 9 5 9

What should that number be?

61 9 **62** 7 **63** 8 **64** 10 **65** 5

14. A school is most likely to have—
 (66) maps (67) books (68) a janitor (69) a teacher (70) a blackboard

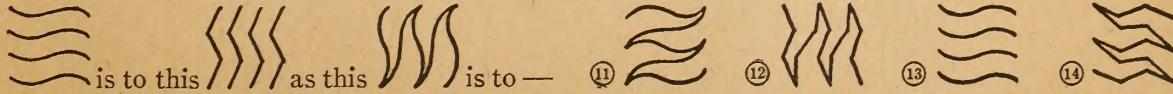
15. What letter in the word WASHINGTON is the same number in the word (counting
from the beginning) as it is in the alphabet?

71 A **72** N **73** G **74** T **75** O

16. Which word makes the truest sentence? Fathers are (?) wiser than their sons.
 (76) always (77) usually (78) much (79) rarely (80) never

17. Four of these five things are alike in some way. Which one is not like the other four?
 (1) nut (2) turnip (3) rose (4) apple (5) potatoes

18. The opposite of frequently is—
 (6) occasionally (7) seldom (8) never (9) periodically (10) often



19. This **W** is to this **V** as this **S** is to— **11** **W** **12** **V** **13** **S** **14** **S**

20. At a dinner there is always—

16 soup **17** wine **18** food **19** waiters **20** dishes

21. If 10 boxes full of apples weigh 400 pounds, and each box when empty weighs 4 pounds,
how many pounds do all the apples weigh?

21 40 **22** 360 **23** 396 **24** 400 **25** 404

22. If a boy can run at the rate of 5 feet in $\frac{1}{5}$ of a second, how many feet can he run in 10 seconds? (26) 1 (27) 50 (28) 250 (29) 2 (30) 25

23. A thermometer is related to temperature as a speedometer is to — (31) fast (32) automobile (33) velocity (34) time (35) heat

24. "State of changing place" is a good definition for — (36) advancement (37) retardation (38) rotation (39) motion (40) revision

25. If the first two statements following are true, the third is (?).
All residents in this block are Republicans.
Smith is not a Republican. Smith resides in this block.
(41) true (42) false (43) not certain

26. If the words below were arranged to make a good sentence, with what letter would the second word of the sentence begin?
same means big large the as
(46) a (47) b (48) m (49) s (50) t

27. Sunlight is to darkness as (?) is to stillness.
(51) quiet (52) sound (53) dark (54) loud (55) moonlight

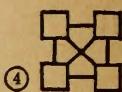
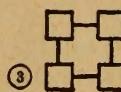
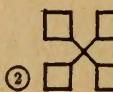
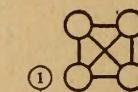
28. A grandmother is always (?) than her granddaughter.
(56) smarter (57) more quiet (58) older (59) smaller (60) slower

29. Such things as looks, dress, likes, and dislikes indicate one's — (61) character (62) wisdom (63) personality (64) gossip (65) reputation

30. A tree always has — (66) leaves (67) fruit (68) buds (69) roots (70) a shadow

31. In general it is safest to judge a man's character by his — (71) voice (72) clothes (73) deeds (74) wealth (75) face

32. Which of these words is related to many as exceptional is to ordinary?
(76) none (77) each (78) more (79) much (80) few



33. This ○ ○ is to this □ □ as this ○ — ○ is to — (1) (2) (3) (4)

34. What is related to a cube in the same way that a circle is related to a square?
(6) circumference (7) corners (8) sphere (9) solid (10) thickness

35. Which one of these pairs of words is most unlike the other three?
(11) run — fast (12) large — big (13) loan — lend (14) buy — purchase

36. The opposite of awkward is — (16) strong (17) pretty (18) graceful (19) short (20) swift

37. The two words superfluous and requisite mean — (21) the same (22) the opposite (23) neither same nor opposite

38. Of the five words below, four are alike in a certain way. Which one is not like these four?
(26) push (27) hold (28) lift (29) drag (30) pull

39. The idea that the earth is flat is — (31) absurd (32) misleading (33) improbable (34) unfair (35) wicked

40. The opposite of loyal is — (36) treacherous (37) enemy (38) thief (39) coward (40) jealous

41. The moon is related to the earth as the earth is to — (41) Mars (42) the sun (43) clouds (44) stars (45) the universe

42. The opposite of sorrow is — (46) fun (47) success (48) joy (49) prosperity (50) hope

43. If the first two statements are true, the third is (?).
Frank is older than George. James is older than Frank.
George is younger than James.
(51) true (52) false (53) not certain

44. If $2\frac{1}{2}$ yards of cloth cost 30 cents, what will 10 yards cost?
(56) \$1.20 (57) 75¢ (58) 40¢ (59) \$3.00 (60) $37\frac{1}{2}$ ¢

45. Congest means to bring together, condole means to grieve together.
Therefore con means — (61) to bring (62) together (63) to grieve (64) to bring or grieve together

46. The law of gravitation is —
 (66) obsolete (67) absolute (68) approximate (69) conditional (70) constitutional . . .

47. Oil is to toil as (?) is to hate.
 (71) love (72) work (73) boil (74) ate (75) hat

48. If $4\frac{1}{2}$ yards of cloth cost 90 cents, what will $3\frac{1}{2}$ yards cost?
 (76) \$3.15 (77) $86\frac{1}{2}\text{¢}$ (78) 70¢ (79) 89¢ (80) 35¢

49. Which number in this series appears a second time nearest the beginning?

6 4 5 3 7 8 0 9 5 9 8 8 6 5 4 7 3 0 8 9 1

(81) 9 (82) 0 (83) 8 (84) 6 (85) 5

50. This  is to this  as this  is to — (86)  (87)  (88)  (89)  

51. If the first two statements following are true, the third is (?).

Some of our citizens are Methodists. Some of our citizens are doctors.
Some of our citizens are Methodist doctors.

(1) true (2) false (3) not certain

52. Which one of the five words below is most unlike the other four?

(6) fast (7) agile (8) run (9) quick (10) speedy

53. One who says things he knows to be wrong is said to be —

(11) careless (12) misled (13) conceited (14) untruthful (15) prejudiced

54. If the words below were arranged to make the *best* sentence,

with what letter would the last word of the sentence end?

sincerity traits courtesy character of desirable and are

(16) r (17) y (18) s (19) e (20) d

55. If a strip of cloth 36 inches long will shrink to 33 inches when washed,
how many inches long will a 48-inch strip be after shrinking?

(21) 47 (22) 44 (23) 45 (24) 46 (25) $45\frac{1}{2}$

56. Which of these expressions is most unlike the other three?

(26) draw pictures (27) clean house (28) come home (29) work problems

57. If the following words were seen on a wall by looking at a mirror on the opposite wall,
which word would appear exactly the same as if seen directly?

(31) MEET (32) ROTOR (33) MAMA (34) DEED (35) TOOT

58. Find the two letters in the word ACTOR which have just as many letters between them in
the word as in the alphabet. Which one of these two letters comes first in the alphabet?

(36) A (37) C (38) T (39) O (40) R

59. A surface is related to a line as a line is to a —

(41) solid (42) plane (43) curve (44) point (45) string

60. One number is wrong in the following series.

1 2 4 7 11 16 23

What should that number be?

(46) 3 (47) 6 (48) 10 (49) 16 (50) 22



61. This  is to this  as this  is to — (51)  (52)  (53)  (54) 

62. How many of the following words can be made from the letters in the word
STRANGLE, using any letter any number of times?

greatest, tangle, garage, stresses, related, grease, nearest, reeling

(56) 7 (57) 6 (58) 3 (59) 4 (60) 5

63. Which of the following is a trait of character?

(61) reputation (62) wealth (63) influence (64) fickleness (65) strength

64. A statement the meaning of which is not definite is said to be —
 (66) erroneous (67) doubtful (68) ambiguous (69) distorted (70) hypothetical

65. Evolution is to revolution as crawl is to —
 (71) baby (72) floor (73) stand (74) run (75) hands and knees

66. Coming is to come as now is to —
 (76) today (77) some time (78) tomorrow (79) before now (80) hereafter

67. One number is wrong in the following series.
 1 2 4 8 16 32 64 96
 What should that number be?
 (1) 3 (2) 6 (3) 12 (4) 48 (5) 128

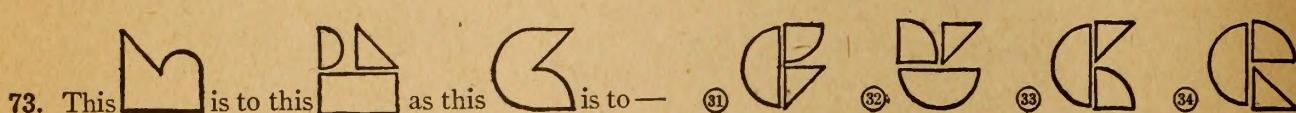
68. If George can ride a bicycle 60 feet while Frank runs 40 feet, how many feet can George ride while Frank runs 30 feet?
 (6) 50 (7) 10 (8) 45 (9) 20 (10) 70

69. What letter is the fourth letter to the left of the letter which is midway between D and I in the word REPRODUCTION?
 (11) C (12) R (13) O (14) N (15) D

70. Which of the five things following is most like these three: ivory, snow, and milk?
 (16) butter (17) rain (18) cold (19) cotton (20) water

71. A hotel serves a mixture of 2 parts cream and 3 parts milk.
 How many pints of milk will it take to make 25 pints of the mixture?
 (21) 25 (22) $16\frac{2}{3}$ (23) 15 (24) $12\frac{1}{2}$ (25) 10

72. A man who spends his money lavishly for non-essentials is considered to be —
 (26) fortunate (27) thrifty (28) extravagant (29) generous (30) economical

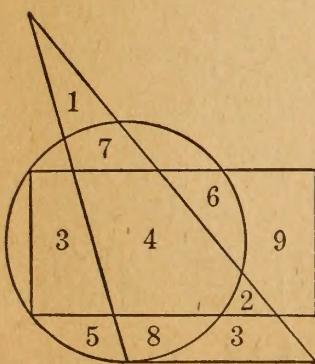


73. This is to this as this is to — (31) (32) (33) (34)

74. If the first two statements following are true, the third is (?).
 One cannot become a good violinist without much practice.
 Charles practices much on the violin. Charles will become a good violinist.
 (36) true (37) false (38) not certain

75. Which of these expressions is most unlike the other three?
 (41) small to tiny (42) pretty to beautiful (43) warm to hot (44) excellent to good

76. If the words below were rearranged to make a good sentence,
 the fifth word in the sentence would begin with what letter?
 life friends valuable to The make asset in a is ability
 (46) 1 (47) f (48) v (49) t (50) a



77. What number is in the space that is in the rectangle and in the triangle but not in the circle?
 (51) 1 (52) 2 (53) 3 (54) 4 (55) 5

78. What number is in the same geometrical figure or figures (and no others) as the number 6?
 (56) 1 (57) 2 (58) 3 (59) 4 (60) 5

79. How many numbers are there each of which is in two geometrical figures but only two?
 (61) 1 (62) 2 (63) 3 (64) 4 (65) 5

80. If a wire 40 inches long is to be cut so that one piece is $\frac{2}{3}$ as long as the other piece, how long must the shorter piece be?

(66) $26\frac{2}{3}$ in. (67) $39\frac{1}{3}$ in. (68) 18 in. (69) 24 in. (70) 16 in.

ANSWER SHEET

Otis Quick-Scoring : Gamma : Bm

Page 6

66	67	68	69	70
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71	72	73	74	75
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76	77	78	79	80
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56 57 58 59 60

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66 67 68 69 70

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Page 5

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Page 4

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1 2 3 4

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6 7 8 9 10

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11 12 13 14

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16 17 18 19 20

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21 22 23

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26 27 28 29 30

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31 32 33 34 35

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41 42 43 44 45

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46 47 48 49 50

42

51 52 53

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56 57 58 59 60

44

61 62 63 64 65

45

Page 3

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21	22	23	24	25
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36 37 38 39 40

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41 42 43 44 45

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46 47 48 49 50

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61 62 63 64 65

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66 67 68 69 70

36

1 2 3 4 5

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71 72 73 74 75

38

76 77 78 79 80

39

1 2 3 4 5

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11 12 13 14

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21 22 23 24 25

42

1. The opposite of love is —
 (1) like (2) anger (3) hate (4) strange (5) lover

2. If 3 pencils cost 10 cents, how many pencils can be bought for 50 cents?
 (6) 5 (7) 30 (8) 15 (9) 3 (10) 150

3. A man does not always have —
 (11) arteries (12) skin (13) muscle (14) teeth (15) blood

4. The opposite of honor is —
 (16) glory (17) cowardice (18) disgrace (19) fear (20) defeat

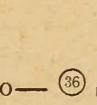
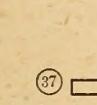
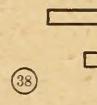
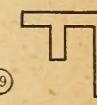
5. Which of these words would come first in the dictionary?
 (21) none (22) take (23) nest (24) told (25) near

6. A word meaning the same as effect is —
 (26) cause (27) affect (28) result (29) change (30) answer

7. Lead is cheaper than silver because it is —
 (31) duller (32) more plentiful (33) softer (34) heavier (35) less useful

8. The first drawing is related to the second in the same way that the third one is to
 one of the remaining four. Which one? 



This **R** is to this  as this **F** is to — (36)  (37)  (38)  (39) 

9. The opposite of gentle is —
 (41) strong (42) rough (43) humane (44) thoughtless (45) careless

10. A contest always has —
 (46) an umpire (47) applause (48) spectators (49) opponents (50) victory

11. The opposite of cowardly is —
 (51) loyal (52) strong (53) treacherous (54) brave (55) friendly

12. A party consisted of a man and his wife, his three sons and their wives,
 and three children in each of the sons' families.
 How many were there in the party?
 (56) 8 (57) 11 (58) 14 (59) 16 (60) 17

13. Which word is needed to begin the following sentence?
 — a straight-line geometrical figure has only three straight sides, it is a triangle.
 (61) Although (62) Since (63) If (64) Now that (65) Because

14. A street always has —
 (66) asphalt (67) curbs (68) lights (69) width (70) gutters

15. What letter in the word SUPERFLUOUS is the same number in the word
 (counting from the beginning) as it is in the alphabet?
 (71) E (72) P (73) F (74) S (75) U

16. A father is always (?) than his son.
 (76) wiser (77) older (78) richer (79) stronger (80) taller

17. Of the five words below, four are alike in a certain way. Which one is not like these four?
 (1) walk (2) run (3) kneel (4) skip (5) jump

18. The opposite of seldom is —
 (6) never (7) frequently (8) invariably (9) always (10) many

19. This  is to this  as this  is to — (11)  (12)  (13)  (14) 

20. If 10 boxes full of oranges weigh 500 pounds, and each box when empty weighs 5 pounds,
 how many pounds do all the oranges weigh? (16) 495 (17) 550 (18) 450 (19) 505 (20) 490

21. One number is wrong in this series: 1 6 2 7 3 8 4 9 5 10 7 11
 What should that number be?
 (21) 11 (22) 6 (23) 10 (24) 8 (25) 12

22. If a boy can run at the rate of 8 feet in $\frac{1}{3}$ of a second, how many feet can he run in 10 seconds?
 (26) 10 (27) 24 (28) 240 (29) 80 (30) 300

23. A sewing machine is related to a needle as a typewriter is to —
 (31) a pin (32) a cloth (33) a pen (34) ink (35) a page

24. Forward motion is a good definition for —
 (36) transfer (37) rotation (38) entrance (39) progress (40) retardation

25. If the first two statements following are true, the third is (?).
 All members of this club are Republicans. Smith is not a Republican.
 Smith is a member of this club.
 (41) true (42) false (43) not certain

26. If the following words were arranged to make the best sentence, the *last* word of the sentence would begin with what letter?
 tests pupils mental thousands have of taken
 (46) m (47) p (48) t (49) h (50) o

27. An egg is related to a bird in the same way that (?) is related to a plant.
 (51) shell (52) seed (53) leaf (54) feather (55) root

28. Sound is related to quiet in the same way that sunlight is to —
 (56) bright (57) evaporation (58) darkness (59) a cellar (60) noise

29. Which word makes the truest sentence? Women are (?) shorter than their husbands.
 (61) always (62) much (63) usually (64) rarely (65) never

30. What people say about a person constitutes his —
 (66) character (67) gossip (68) disposition (69) reputation (70) personality

31. A home always has —
 (71) a mother (72) hearth (73) familiarity (74) congeniality (75) music

32. A person who never pretends to be anything other than what he is, is said to be —
 (76) loyal (77) hypocritical (78) courageous (79) meek (80) sincere

33. This  is to this  as this  is to — (1)  (2)  (3)  (4) 

34. An ellipse is related to a circle as a diamond is to a —
 (6) ring (7) rectangle (8) square (9) oval (10) cube

35. Which of these pairs of words is most unlike the other three?
 (11) work — hard (12) little — small (13) blossom — flower (14) grief — sorrow

36. The opposite of destroy is —
 (16) alter (17) continue (18) create (19) destroy (20) change

37. The two words repentant and reluctant mean —
 (21) the same (22) neither same nor opposite (23) the opposite

38. Which of the five things following is most unlike the other four?
 (26) nail (27) hammer (28) screw (29) bolt (30) tack

39. The statement that the moon is made of green cheese is —
 (31) absurd (32) misleading (33) improbable (34) unfair (35) wicked

40. The opposite of economical is —
 (36) extravagant (37) stingy (38) cheap (39) value (40) rich

41. A word meaning the same as controversy is —
 (41) conversation (42) dispute (43) discussion (44) lawsuit (45) dialogue

42. The opposite of skillful is —
 (46) lazy (47) weak (48) clumsy (49) slow (50) novice

43. If the first two statements following are true, the third is (?).
 George is older than Frank. James is older than George.
 Frank is younger than James.
 (51) true (52) false (53) not certain

44. If $2\frac{1}{2}$ yards of cloth cost \$2, how many dollars will 10 yards cost?
 (56) 8 (57) 25 (58) 20 (59) 4 (60) 5

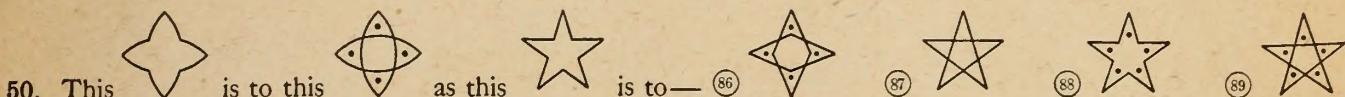
45. Superimpose means to lay above; superinduce means to bring in above. Therefore super means —
 (61) to lay (62) above (63) to bring (64) to lay or to bring (65) to lay in

46. Find the letter in this sentence which appears a second time nearest the beginning.
 (66) F (67) e (68) t (69) i (70) h.....

47. Which one of the five words below is most like these three: love, hate, joy?
 (71) memory (72) taste (73) health (74) anger (75) life.....

48. If $4\frac{1}{2}$ yards of cloth cost 90 cents, what will $2\frac{1}{2}$ yards cost?
 (76) \$2.25 (77) 88¢ (78) 50¢ (79) $87\frac{1}{2}\text{¢}$ (80) $11\frac{1}{4}\text{¢}$

49. If the settlement of a difference between two parties is made by a third party, it is called —
 (81) a compromise (82) a truce (83) a promise (84) an injunction
 (85) an arbitration.....



50. This is to this as this is to — (86) (87) (88) (89)

51. If the first two statements following are true, the third is (?).
 Some of Brown's friends are Catholics. Some of Brown's friends are lawyers.
 Some of Brown's friends are Catholic lawyers.
 (1) true (2) false (3) not certain.....

52. Which one of the five words following is most unlike the other four?
 (6) drop (7) come (8) here (9) stay (10) have.....

53. A man who is averse to change and progress is said to be —
 (11) democratic (12) radical (13) anarchistic (14) conservative (15) liberal.....

54. If a strip of cloth 32 inches long will shrink to 28 inches when washed, how many inches long will a 24-inch strip of the same cloth be after shrinking?
 (16) 21 (17) 20 (18) 22 (19) 23 (20) 24.....

55. If the words below were rearranged to make a good sentence, the last word of the sentence would begin with what letter?
 preparation training life A excellent an college is for
 (21) t (22) l (23) p (24) e (25) c.....

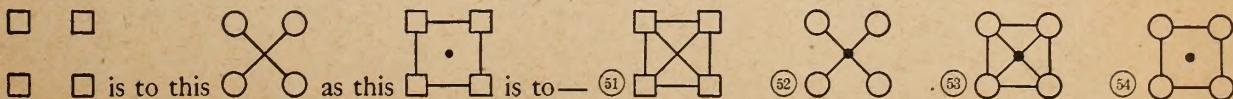
56. Which of these expressions is most unlike the other three?
 (26) shovel snow (27) sweep floors (28) walk fast (29) write letters.....

57. If the following names were seen on a wall by looking at a mirror on the opposite wall, which name would appear exactly the same as if seen directly?
 (31) ANNE (32) HANNAH (33) LULU (34) ADA (35) OTTO.....

58. Find the two letters in the word DIVOT which have just as many letters between them in the word as in the alphabet. Which one of these two letters comes first in the alphabet?
 (36) D (37) I (38) V (39) O (40) T.....

59. A point is to a line as a line is to a —
 (41) curve (42) pencil (43) dot (44) surface (45) solid.....

60. One number is wrong in the following series: 0 1 3 6 10 15 21 29 36
 What should that number be?
 (46) 9 (47) 2 (48) 37 (49) 5 (50) 28.....



61. This is to this as this is to — (51) (52) (53) (54)

62. How many of the following words can be made of the letters in the word CELEBRATE, using any letter twice?
 create better traceable erect tables rabble crated prattle barter
 (56) 5 (57) 6 (58) 3 (59) 4 (60) 2.....

63. Which of the following is a trait of character?
 (61) personality (62) esteem (63) love (64) generosity (65) health.....

64. One can measure a city block _____ by pacing.
 (66) evenly (67) carefully (68) approximately (69) cautiously (70) correctly.....

65. A stone falling freely from a cliff —
 (71) accentuates (72) accompanies (73) acquits (74) accelerates (75) activates

66. Going is to went as now is to —
 (76) today (77) tomorrow (78) presently (79) earlier (80) later.....

67. One number is wrong in the following series.
 What should that number be?
 1 4 9 16 25 36 45 64
 (1) 7 (2) 14 (3) 23 (4) 34 (5) 49

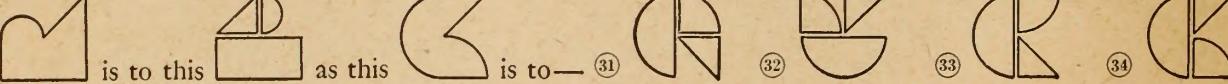
68. If Frank can ride a bicycle 30 feet while George runs 20 feet,
 how many feet can Frank ride while George runs 30 feet?
 (6) 15 (7) 40 (8) 45 (9) 50 (10) 60

69. Write the letter of the alphabet which is the third to the right of the letter
 which is midway between M and Q.
 (11) N (12) R (13) L (14) O (15) P

70. Four of the things following are alike in a certain way. Which one is not like these four?
 (16) snow (17) ivory (18) cotton (19) soot (20) milk

71. A hotel serves a mixture of 3 parts cream and 2 parts milk.
 How many pints of cream will it take to make 25 pints of the mixture?
 (21) 75 (22) 24 (23) 15 (24) $92\frac{1}{2}$ (25) $8\frac{1}{3}$

72. A man who is influenced in making a decision by preconceived opinions is said to be —
 (26) influential (27) hypocritical (28) prejudiced (29) decisive (30) impartial

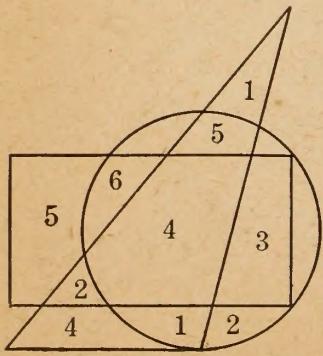


73. This is to this as this is to — (31) (32) (33) (34)

74. If the first two statements following are true, the third is (?).
 It takes perseverance to become a skillful juggler. This boy has perseverance.
 He will become a skillful juggler.
 (36) true (37) false (38) not certain

75. Which of these pairs of words is most unlike the other three?
 (41) go and come (42) strong and weak (43) in and out (44) south and west

76. Which of the following is related to stars in the same way
 that physiology is to blood?
 (46) telescope (47) astronomy (48) darkness (49) light waves (50) chemistry



77. What number is in the space which is in the rectangle and in the triangle
 but not in the circle?
 (51) 1 (52) 2 (53) 3 (54) 4 (55) 5

78. What number is in the same geometrical figure or figures (and no others)
 as the number 6?
 (56) 1 (57) 2 (58) 3 (59) 4 (60) 5

79. How many spaces are there each of which is in two geometrical figures
 but only two?
 (61) 7 (62) 6 (63) 3 (64) 4 (65) 5

80. If a wire 40 inches long is to be cut so that one piece is $\frac{2}{3}$ as long as the other piece,
 how many inches long must the longer piece be?
 (66) $26\frac{2}{3}$ (67) 30 (68) $39\frac{1}{3}$ (69) $13\frac{1}{3}$ (70) 24

**1942 Edition
HIGH SCHOOL**

Confidential

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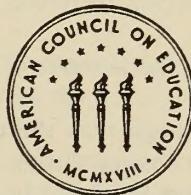
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Manual of Instructions

American Council on Education
Psychological Examination
For High School Students

Prepared by L. L. THURSTONE and THELMA GWINN THURSTONE



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744 Jackson Place, Washington, D. C.

I. Purpose of the Examination

The purpose of the Psychological Examination of the American Council on Education is to appraise what has been called scholastic aptitude or general intelligence, with special reference to the requirements of most high school curricula. A large number of different tests have been used for this purpose. It has been found that, in general, linguistic tests give higher correlations with scholarship than do quantitative tests. This higher correlation is probably, in part, due to the fact that most high-school courses depend more upon linguistic abilities than upon the abilities involved in quantitative thinking. For the scientific and technical curricula the quantitative tests may be more significant.

These considerations indicate the desirability of isolating the several mental abilities and of appraising them separately. A complete program of this kind would be the ideal basis for educational and vocational counseling, and it is the objective toward which psychological research should be directed. In 1942 the American Council on Education published the Chicago Tests of Primary Mental Abilities. These tests yield a profile of a pupil in terms of six primary mental abilities. These tests are intended primarily for counseling at the eighth grade and high school levels and are accompanied by norms for ages 11 to 18. It is planned to make a similar series of tests available for use with college students. In the 1938 edition of the high school psychological examination we introduced a practical compromise whereby two subscores were obtained from the examination, namely, a subscore for two linguistic tests, and another subscore for two quantitative tests. These two subscores do not represent primary mental abilities, but they represent two groups of abilities significant for curricula that are dominantly linguistic or technical.

Since the introduction of the electric scoring machine a few years ago, many psychological and educational tests have been adapted to machine scoring. In response to demand from the larger institutions where the scoring machines have been installed, the Psychological Examination was adapted to machine scoring in an alternative form. Two forms were made available for several years, one for hand scoring and one for machine scoring.

As in 1941, there is one form of the 1942 edition. All students take the test in exactly the same way, marking their answers on separate answer sheets. The answer sheet is scored by hand or by means of the scoring machine. Several advantages result from this arrangement of the examination.

One of the problems with recent editions of the Psychological Examination has been the comparability of norms for the two forms. The machine-scored form was used mostly by the larger institutions where scoring machines are more common. The hand-scored form was used by most of the smaller schools and by some of the larger ones. In tabulating norms for the two forms we were not able to insure that the two populations were comparable, and the results could not be combined into the same set of norms. Consequently, the users of either form were limited to the norms based on the schools that used the same form. By introducing the separate answer sheet for the hand-scored form as well as for the machine-scored form, the task for the subjects is identical in the two forms. The norms can, therefore, be assembled into the same tables, irrespective of the way in which the test papers are scored.

This procedure reduces to a minimum the amount of labor in scoring, which becomes quite simple when only one answer sheet has to be scored.

The machine-scored test had the advantage that the test booklets could be used several times. By providing the hand-scored form with separate answer sheets, this advantage is also extended to the users of the hand-scored test. The same set of test booklets can be used for several groups of students, provided that the students do not make marks in the test booklets.

The 1942 edition consists of the four tests that have been used for several years. All of the tests in the 1942 edition have been included in several test experiments with factorial analyses to determine the primary mental abilities. These studies have justified the grouping of the tests in two general classes, as follows:

Linguistic Tests: (the L-score)

Same-Opposite
Completion

Quantitative Tests: (the Q-score)

Arithmetical Reasoning
Number Series

It is not recommended that the four separate test scores be used for any counseling, but there seems to be justification for using the two principal subscores as well as the total or gross score in this manner.

The test forms should be found useful in handling those problems in which it is advisable to distinguish a student's mental abilities from his preparation and his industry. Faculty action in the case of a student who is failing can be intelligently guided if one has some means of knowing to what extent the student has applied himself to his work and what his mental abilities are. Very different faculty action can be taken, depending on which of these three factors may be held primarily responsible for a student's failure. It is to be hoped that these psychological test forms may lead to the early discovery of bright students. In those schools where sectioning of classes in accordance with ability or preparation is customary, these test forms may serve as part of the evidence upon which the sectioning is based.

Perhaps a word should be said about different interpretations of test scores. Those who have used psychological tests and who have become convinced of their merits sometimes overestimate the significance of the test scores. While the scores do show roughly the mental alertness of the student, they should not be thought of as measuring mentality with high accuracy. The scores are roughly indicative of the level of mental alertness of the student, but they should not be taken so seriously as to exclude other evidences of intelligence and talent in individual cases. On the other hand, it is undeniably true that the psychological test scores tell us much more about the mental alertness of students than could be ascertained in a personal interview.

II. How To Give the Examination

The conditions that should be observed in conducting these tests are similar to those which should be observed in giving any objective group test by the time-limit method. In order to conduct these tests properly, there should be one examiner in charge of the whole group and at least one proctor for every twenty students. In giving his instructions, the examiner should avoid unnecessary severity, which sometimes intimidates students so that they do not do themselves justice. On the other hand, the examiner must command enough respect to have his instructions carried out. If the examiner is skillful, he will get his students to take a congenial and cooperative attitude toward the test and a competitive attitude toward each other.

The students must have a smooth, hard surface on which to place their separate answer sheets. If their chair arms or desks are not smooth, some kind of smooth, hard surface must be provided for each student.

See that the students are seated far enough apart so that no one can read his neighbor's answers.

If the examination is to be scored by a scoring machine, the students must be supplied with special pencils which are obtained from the International Business Machines Corporation, New York. Instruct the proctors to distribute the pencils, one to each student. State emphatically that only the special pencils are to be used.

Proceed in the following manner:

1. Announce that no scratch paper is necessary for any of these tests, since the answer sheet contains a special section which may be used for scribbling.

2. After these preliminary announcements have been made, and when it has been ascertained that every student is seated in an appropriate place and supplied with a pencil, instruct the proctors to distribute the test pamphlets and the answer sheets, one of each to each student. The test pamphlets should be distributed with the title page up and the answer sheets with Page A up.

3. While the proctors are distributing the pamphlets and answer sheets, announce that the pamphlets should not be opened until further instructions are given.

4. When each student has been supplied with an answer sheet, ask the students to print their names and the name of the school in the designated spaces on Page A of the answer sheet. If any other information is desired, such as age, department or school, method of admission, nationality of parents, preparatory school, and so on, instruct the students to write it in the left-hand margin on Page B of the answer sheet. This addi-

tional information will vary among the different schools. The space is, therefore, left blank so that the examiner may instruct his students how to report the additional information.

5. When the desired information has been filled in on the answer sheets, ask the students to open the test pamphlets to Page 2 and fold the booklets back. These "General Instructions" are to be read aloud by the examiner, who should insert any explanatory comments or blackboard diagrams which will help to clarify the directions. After reading the "General Instructions," announce that the students are not to ask any questions nor to try to communicate with the examiner or the proctors or other students during the examination.

6. The time limits suggested for the practice problems are approximate. The examiner should make sure that students understand the task. Test scores will not be reliable if the students are rushed through the practice problems. The examiner should notice when all students have completed the practice problems. The time required may be a little more or a little less than the amounts given in the manual. Announce that each *test proper* has a specified time limit. Announce that in each case there will be a starting signal at which everyone begins to work and a stop signal at which everyone stops promptly and waits for further instructions.

7. Announce with special emphasis and with one or more repetitions: (1) that *under no circumstances may any student begin a set of practice problems or a test until the starting signal for that particular set of practice problems or test has been given*; (2) that *no student may turn back to a test after the time limit for it has expired*; and (3) that *each test must be worked on during, and only during, the specified time for it as announced by the examiner*.

8. The practice problems are accompanied by printed instructions. These instructions are to be read aloud by the examiner. The students should work each practice problem before the examiner proceeds to the next instruction. The printed directions at the beginning of each test proper are to be read silently by the student after the examiner says "Go," and *the time for reading them is to be included in the time limit for the test*. *The examiner should start timing a test immediately after he says "Go."* This instruction must be followed exactly in order to make scores from different schools comparable.

9. Say to the students: "You must not begin to work on the tests until I give the signal. Do not turn any pages yet."

The following starting signal can be used to advantage: "The first test is called Same-Opposite—Same-Opposite Test. There are some practice problems on Page 3. I shall read the directions with you. Turn to Page 3. Page A of the answer sheet should be up."

10. The proctors should be alert to note that every student in their sections turns to Page 3 and begins to work on the first set of practice problems. They should see that each student finds on the answer sheet the section labeled "SAME-OPPOSITE, Practice Problems, Page 3." It is the duty of the proctors during each time interval to see that each student is working on the proper part of the examination and on the corresponding section of the answer sheet. The answer sheet should be placed under the test booklet so that the answer spaces being marked are as near as possible to the questions being answered. No student should be allowed to return to one of the tests for which the time has expired even if he finishes the current test ahead of time. No student should be allowed to turn the pages of his pamphlet to tests ahead of the current test. Each test must be worked on during, and only during, the specified time for it as announced by the examiner.

11. Allow about 4 minutes for the practice problems on the Same-Opposite Test. When all the students have finished the practice problems, say: "You will have 6 minutes for the test proper, the Same-Opposite Test, on the next page. Turn to Page 4 and fold your book back. Go ahead."

The proctors are to see that these instructions are carried out.

12. After exactly 6 minutes, say: "STOP. Everybody stop. Even if you have not finished the Same-Opposite Test, you must stop. The next test is the Completion Test. Turn to the practice problems on Page 5. Page A of the answer sheet should be up. I shall read the directions with you."

13. Allow about 5 minutes for the practice problems. Then say: "You will have 9 minutes for the test proper, the Completion Test, on Pages 6 and 7. When you have finished Page 6, turn to Page 7 and keep right on working until you are told to stop. Turn to Page 6 and fold your book back. Go ahead."

14. After exactly **9** minutes, say: "STOP. Everybody stop. Even if you have not finished the Completion Test, you must stop. The next test is the Arithmetic Test. Turn to the practice problems on Page 9. Turn the answer sheet to Page B. I shall read the directions with you."

15. Allow about 5 minutes for the practice problems. Then say: "You will have 12 minutes for the test proper, the Arithmetic Test, on the next page. Turn to Page 10 and fold your book back. Go ahead."

16. After exactly **12** minutes, say: "STOP. Everybody stop. Even if you have not finished the Arithmetic Test, you must stop. The next test is the Number Series Test. Turn to the practice problems on page 11. Page B of the answer sheet should be up. I shall read the directions with you."

17. Allow about 5 minutes for the practice problems. Then say: "You will have 8 minutes for the test proper, the Number Series Test, on the next page. Turn to Page 12 and fold your book back. Go ahead."

18. After exactly **8** minutes, say: "STOP. Everybody stop. Even if you have not finished the Number Series Test, you must stop. Give your test pamphlets, answer sheets and pencils to the proctors."

III. How To Score the Examination

In the upper left-hand corner of the answer sheet is provided a table for recording the performance of the student.

The L-score is the number of right answers on the first two tests of the examination. The Q-score is the number of right answers on the last two tests of the examination. The total score is the sum of the L-score and the Q-score. The scorer should record the Q-score on Page B when he scores Page B of the answer sheet. The Q-score is later transferred to Page A of the answer sheet and combined with the L-score to obtain the total score.

The right answers to the four tests are as follows:

SAME-OPPOSITE: pleasant, true, youthful, timely, slight, indifferent, shifting, deferential, cultured, eager, trifling, unwavering, puny, partial, cooked, watery, exalted, prodigious, resilient, moral, peaceful, covetous, negligent, blithe, fleeting, matchless, stern, pernicious, believing, intermittent, brusque, prosaic, apathetic, dejected, hollow, adequate, fit, thoughtful, vivid, menacing, backward, auspicious, degrading, orthodox, frivolous, bland, faultless, stealthy, unaware, flexible.

COMPLETION: O (oasis), A (arrow), N (nursery), B (banquet), M (morning), F (future), M (minute), D (definition), L (lock), C (century), P (perfume), S (saddle), B (bullet), P (primer), F (frame), T (traitor), L (laboratory), F (fare), C (cork), T (rousseau), A (autobiography), S (slum), I (infant), P (profile), D (detour), H (hermit), A (acrobat), P (palace), D (debut), P (pilgrim), V (volunteer), T (tricycle), S (snout), P (periscope), A (adult), E (equator), T (trademark), B (bait), S (studio), P (pane), C (cloud), A (arson), I (insomnia), C (convalescence), C (carat), M (megaphone), H (habitat), P (pauper), C (chivalry), P (pessimist), S (spike), J (javelin), F (friction), C (curriculum), P (parable), P (piccolo), M (mason), S (silhouette), C (cushion), F (foliage).

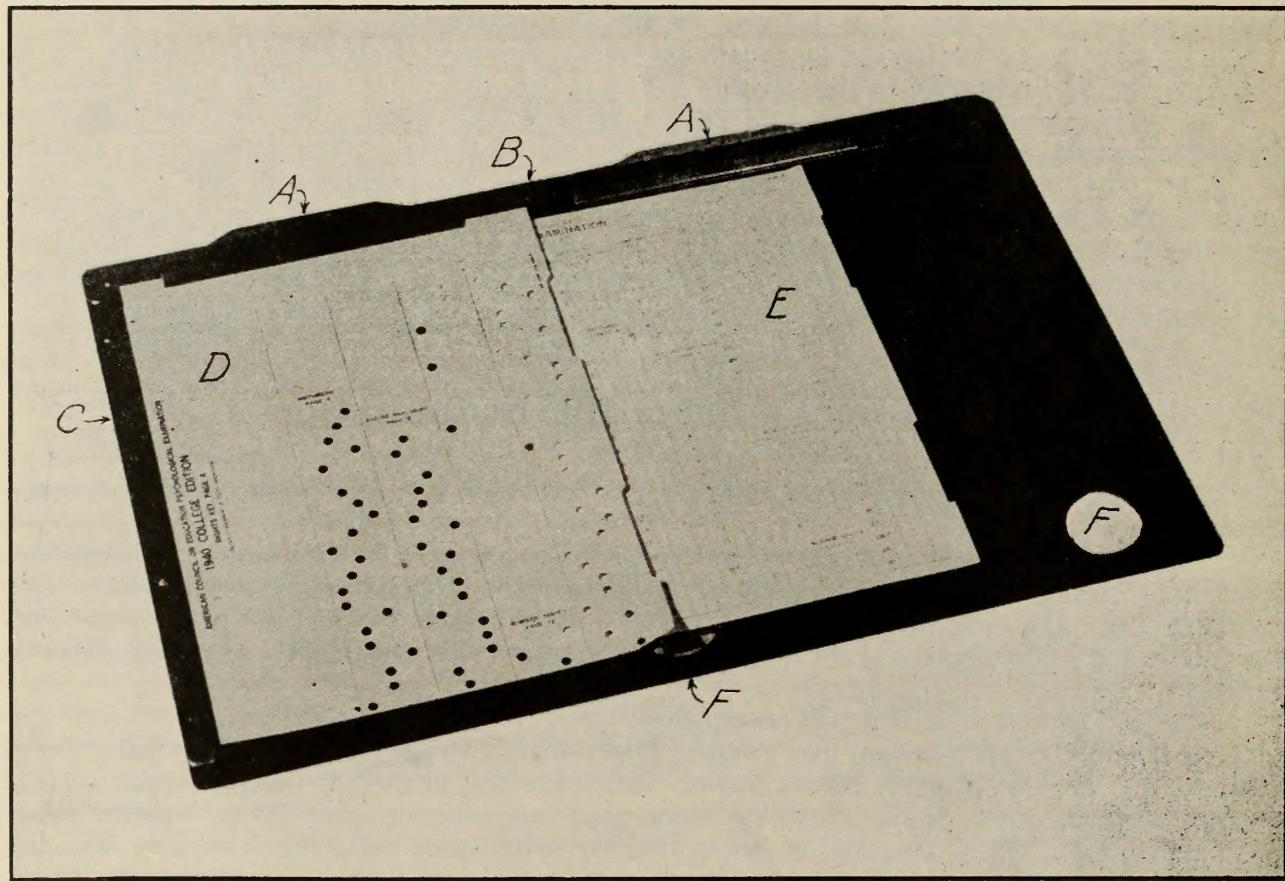
ARITHMETIC: \$10.00, \$45, \$600, 195, 11:05, \$7.17, \$108, 30, 140, 9, \$30, 1250, 5, 17, $\frac{1}{2}$, \$.40, $13\frac{1}{2}$, $12\frac{1}{2}$, 140, \$16.

NUMBER SERIES: 42, 16, 38, 21, 15, 8, 14, 134, 19, 28, 8, 23, 20, 26, 9, 51, 18, 50, 8, 14, 3, 14, 0, 13, 8, 12, 16, 8, 2, 6.

A Manual Scoring Board

For several years we have been using a scoring board for the hand scoring of psychological tests. The device is very simple and it saves not only considerable time in scoring but it has been found also to reduce clerical errors. It is not patented, and it will be described here as a suggestion for those who want to make it. The board is manufactured and distributed by C. H. Stoelting and Company in Chicago.

The scoring board is shown in the figure. It consists of a board of plywood or masonite which is cut



somewhat larger than a double letter-size sheet. Two clips A are mounted at the upper edge of the board as shown. These are similar to the clips on the familiar clip boards. Along the same upper edge is fastened a metal strip B and along the left edge is another metal strip C. These strips serve as guides for the exact location of the test paper to be scored. The stencil D is fastened in position under the clip A as shown. When the stencil has been mounted in the correct position under the clip, it remains there for the scoring without further handling or adjustment.

The figure shows the test paper E which slides under the stencil until it meets the two guide strips B and C. The test paper is then in correct position under the stencil holes so that it can be scored. When it has been scored, the paper is removed and the next paper is inserted under the fixed stencil. In this manner the scoring involves the handling of only one paper, the test, instead of both the stencil and test paper as in ordinary hand scoring. The two holes shown at F facilitate lifting the test paper from its scoring position. The two clips are provided so that both sides of the test paper can be scored in rapid succession. That involves the insertion of two stencils, one under each clip.

The usual hand-scoring procedure requires that the clerk match the stencil carefully over the test paper for each paper that is to be scored. The present scoring board facilitates this matching because when the test paper is moved under the stencil to the two guide strips, it is automatically in the correct position for scoring. The exact position of the stencil can be easily adjusted under the clip.

If the stencil and the test paper are of the same size, it is necessary to paste a strip of cardboard to the upper edge of the stencil in order to make the stencil slightly longer for insertion under the clip.

When a large amount of hand scoring is to be done, the scoring board saves about half the time ordinarily required for this work.

IV. Norms of Performance

Tables of percentiles should be prepared for three sets of scores: (1) the L-scores, which depend upon linguistic ability; (2) the Q-scores, which represent ability to think in quantitative terms; and (3) the total scores, which involve both abilities. The answer sheet contains spaces for recording each student's three percentile ranks, corresponding to his L-score, his Q-score, and his total score.

A set of record sheets, on which the scores of the students may be entered, is supplied to each of the participating schools. The record sheets have spaces for the L-scores, Q-scores, and total or gross scores.

If any schools send in frequency distributions of scores, we can use them if the class interval is 1 for the L-scores and Q-scores, and 5 for the gross scores.

Record sheets should be returned to L. L. Thurstone, The University of Chicago, Chicago, Illinois.

Some schools may prefer not to have their reports published, but we should like to use their records in preparing norms. In case a school wishes its scores not to be published, it may make this request when scores are sent in.

A preliminary report of norms will be issued as soon as a sufficient number of reports have been received. Comprehensive norms for each edition of the examination are published in Series V of the *American Council on Education Studies* for April of the school year in which the test is current. All records received by the first of March are included in this report.

The high school norms have never been based on as large a number of cases as they should be. High schools using the test can help increase its usefulness to themselves and to other schools by reporting students' scores as promptly as possible. It is hoped that more high schools will send in reports on the 1942 examination.

It should be optional with each school whether or not the scores are to be reported to the students. There is always inquiry from students about the announcement of their test scores. If it is decided to tell students their L-scores, Q-scores, and gross scores, it will be necessary to translate the scores into percentile ranks, because the raw scores are not directly comparable.

unwieldy to handle.

1942 Edition

AMERICAN COUNCIL ON EDUCATION
Psychological Examination
For High School Students

Prepared by L. L. Thurstone and Thelma Gwinn Thurstone



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General Instructions

This examination is different from the ordinary school examinations to which you have been accustomed. The plan for each of these tests is as follows. First, you are given detailed *instructions* about the test, so that you know just what you are expected to do. Then you have some *practice problems*. Then you go to the *test proper*. This is the procedure for each of the four tests in this examination.

The four tests in this examination represent a variety of tasks. Two of them involve thinking of a quantitative sort, while the other two require more linguistic ability. If you find one test hard, do not be discouraged. You may find the next test easier. But you should do your best on all the tests.

People differ markedly in the speed with which they can do these different tests. The tests are long enough to keep everyone busy for the whole time, and you are not expected to complete the tests in the time allowed. By noting how many questions you can answer in a certain length of time, we can determine your speed on each kind of test. You must begin to work on a test promptly when the examiner calls the starting time and stop immediately when he says: "Stop." Do not begin a test until the examiner gives the starting signal for that particular test. Do not turn back to a test after the time for it has expired. You are to work on each test during, and only during, the specified time as announced by the examiner in charge.

You are to record your answers on a separate answer sheet rather than on the pages of the test booklet. Instead of writing down your answers in the usual manner, you will record each answer by blackening the space between a pair of lines. *Do not make any marks or record any answers on the pages of this test booklet.*

Your answer sheet will be scored accurately if you observe carefully the following directions:

1. On the answer sheet, find the *section* which corresponds to the practice problems or test proper on which you are working.
2. Then find the *row of answer spaces* which is numbered the same as the question you are answering.
3. Then find the *pair of dotted lines* which corresponds to the answer you choose and blacken the space.

MISPLACED ANSWERS ARE COUNTED AS WRONG ANSWERS.

4. Indicate each answer with SOLID BLACK PENCIL MARKS drawn vertically between the two dotted lines. Solid black marks are made by going over each mark two or three times and by pressing firmly on the pencil.
5. Make your marks as long as the dotted lines.
6. If you change your answer, erase your first mark completely.
7. Make no unnecessary marks in or around the dotted lines.
8. Keep your answer sheet on a hard surface while marking your answers.
9. Make no folds or creases in the answer sheets.
10. *No scratch paper* is allowed in any of these tests. The answer sheet contains a special section which may be used for scribbling.
11. Fold the pages of your test booklet back so that *only one page is visible*. Place the test booklet to the left. Keep the answer sheet under the test booklet so that the answer spaces being marked are as close as possible to the questions being answered.

(Omit the next paragraph unless the tests are to be machine-scored.)

The examination will be scored by an electric test-scoring machine, which makes use of the fact that a solid black pencil mark will carry a current of electricity in the same way that a copper wire does. **LIGHT PENCIL MARKS MADE WITH A HARD PENCIL WILL NOT CARRY A CURRENT OF ELECTRICITY!** The machine will not give you a correct score unless you indicate your answers with solid black pencil marks made with the *special* pencil which is provided. Do not use any pencil other than the special one provided. The machine cannot distinguish between intended answers and stray pencil marks. If you are careless in erasing, or if you leave unnecessary marks on or near the pairs of lines, such marks may be counted by the machine as wrong answers so that your score will be lower than it should be.

Wait until the examiner gives the starting signal for the first set of practice problems.

Same-Opposite

PRACTICE PROBLEMS

The word at the left in the following line is "many."

1. many	(1) ill	(2) few	(3) down
---------	---------	---------	----------

(4) sour

One of the four words at the right means either the *same* as or the *opposite* of "many." The word "few," which is numbered 2, is the opposite of "many." In the section of the answer sheet labeled "SAME-OPPOSITE, Practice Problems, Page 3," space number 2 in the first row has been blackened.

The word at the left in the second example is "ancient." Select one of the four words at the right that means the *same* as or the *opposite* of "ancient." In the second row on the answer sheet, blacken the space which corresponds to the answer you have selected.

2. ancient	(1) dry	(2) long	(3) happy
------------	---------	----------	-----------

(4) old

You should have blackened the space numbered 4, because 4 corresponds to "old," which means the same as "ancient."

In each of the following lines select the word that means the *same* as or the *opposite* of the word at the left. On the answer sheet, blacken the space which corresponds to the answer you have selected.

3. deep	(1) blue	(2) shallow	(3) tense
---------	----------	-------------	-----------

(4) watery

4. awkward	(1) clumsy	(2) loyal	(3) passive
------------	------------	-----------	-------------

(4) young

5. hot	(1) dry	(2) cooked	(3) red
--------	---------	------------	---------

(4) cold

When the starting signal is given (not yet), turn the page and work more problems of the same kind. Work rapidly because your rating will be the total number of correct answers. You may not be able to finish in the time allowed.

Stop here. Wait for the signal.

In each row, select the word at the right which means the *same* as or the *opposite* of the first word in the row. Blacken the space which corresponds to the word you have selected.

SAME-OPOSITE

1. agreeable	(1) new	(2) stalwart	(3) dark	(4) pleasant	26. inimitable	(1) matchless	(2) optical	(3) outlined	(4) parental
2. legendary	(1) unselfish	(2) true	(3) pleasant	(4) noisy	27. austere	(1) narrow	(2) stern	(3) unhappy	(4) vile
3. elderly	(1) drab	(2) brotherly	(3) absurd	(4) youthful	28. evil	(1) heedless	(2) frantic	(3) volatile	(4) pernicious
4. reasonable	(1) dutiful	(2) dauntless	(3) timely	(4) gracious	29. skeptical	(1) vague	(2) believing	(3) constant	(4) unwise
5. tremendous	(1) brilliant	(2) crude	(3) slight	(4) past	30. incessant	(1) demandable	(2) intermittent	(3) foreign	(4) unhappy
6. nonchalant	(1) actual	(2) indifferent	(3) varied	(4) unruly	31. suave	(1) prevalent	(2) neuter	(3) old	(4) brusque
7. variable	(1) conquered	(2) shifting	(3) bitter	(4) sudden	32. romantic	(1) facial	(2) subdued	(3) judicial	(4) prosaic
8. respectful	(1) deferential	(2) physical	(3) remedial	(4) several	33. energetic	(1) apathetic	(2) balmy	(3) criminal	(4) heroic
9. barbarous	(1) tidal	(2) haughty	(3) cultured	(4) abrupt	34. buoyant	(1) dejected	(2) bestial	(3) clear	(4) savage
10. zestful	(1) stormy	(2) tough	(3) eager	(4) lengthy	35. cavernous	(1) matted	(2) smooth	(3) unsuitable	(4) hollow
11. important	(1) adequate	(2) dishonest	(3) trifling	(4) open	36. effectual	(1) tired	(2) unarmed	(3) wide	(4) adequate
12. staunch	(1) cozy	(2) uneven	(3) unwavering	(4) stupid	37. seemly	(1) poetic	(2) scribbled	(3) local	(4) fit
13. brawny	(1) clever	(2) dim	(3) hazy	(4) puny	38. solicitous	(1) natural	(2) fearless	(3) thoughtful	(4) calm
14. absolute	(1) ungainly	(2) eligible	(3) gaudy	(4) partial	39. intense	(1) likely	(2) supple	(3) vivid	(4) respectful
15. raw	(1) silken	(2) slick	(3) cooked	(4) stale	40. formidable	(1) mystic	(2) obscene	(3) menacing	(4) nodal
16. aqueous	(1) literal	(2) watery	(3) manual	(4) informal	41. precocious	(1) nodding	(2) hairy	(3) endless	(4) backward
17. sublime	(1) liberal	(2) straight	(3) exalted	(4) brisk	42. sinister	(1) auspicious	(2) settled	(3) diligent	(4) tacit
18. immense	(1) prodigious	(2) bloody	(3) wistful	(4) vulgar	43. ignominious	(1) indecisive	(2) degrading	(3) forward	(4) inconstant
19. elastic	(1) trivial	(2) resilient	(3) valid	(4) humorous	44. canonical	(1) flushed	(2) willful	(3) orthodox	(4) frozen
20. ethical	(1) perishable	(2) moral	(3) eloquent	(4) garish	45. staid	(1) frivolous	(2) open	(3) tabular	(4) harsh
21. turbulent	(1) eastern	(2) selective	(3) interested	(4) peaceful	46. pungent	(1) sleepy	(2) bland	(3) doleful	(4) lavish
22. envious	(1) spicy	(2) brainless	(3) covetous	(4) vain	47. impeccable	(1) fearless	(2) grudging	(3) faultless	(4) secret
23. fastidious	(1) musical	(2) famed	(3) negligent	(4) early	48. furtive	(1) drab	(2) rugged	(3) stealthy	(4) placid
24. sorrowful	(1) tolerant	(2) blunt	(3) unsteady	(4) blithe	49. cognizant	(1) next	(2) acquired	(3) unofficial	(4) unaware
25. transient	(1) glib	(2) sensitive	(3) surly	(4) fleeting	50. ductile	(1) plenteous	(2) regional	(3) flexible	(4) silent

Completion

PRACTICE PROBLEMS

Look at the following definition. You are to think of the word that fits the definition.

1. A contest of speed.

B F M P R

The word is *race*. The letter *R* is the first letter in the word *race*. In the section of the answer sheet labeled "COMPLETION, Practice Problems, Page 5," the space indicated by *R* in the first row has been blackened.

Blacken the space corresponding to the first letter of the word which fits the following definition.

2. A place or building for athletic exercises.

C D G H T

The word is *gymnasium*. You should have marked *G* because it is the first letter in the word *gymnasium*.

Do the following examples in the same way:

3. The thin cutting part of an instrument, as of a knife or sword.

A B D H W

4. The wife of a king.

F N P Q V

5. A small or portable bed, as of canvas stretched on a frame.

C H N P T

When the starting signal is given (not yet), turn the page and work more problems of the same kind. Work rapidly because your rating will be the total number of correct answers. You may not be able to finish in the time allowed.

Stop here. Wait for the signal.

Think of the word that fits the definition. Then mark the first letter of that word on the answer sheet.

COMPLETION

1. A fertile or green spot in a waste or desert. L N O T	U	16. One who violates his allegiance and betrays his country. D G P T
2. The missile weapon used with a bow. A G N R	U	17. A place devoted to experimental study in any science. A D E F
3. The part of a house appropriated to the care of children. D F H L	N	18. The price of transportation for a person. B F H K
4. A feast, often ceremonious and followed by speeches. A B E H	J	19. A stopper for a bottle to prevent the flow of liquid. C D G H
5. The early part of the day. C H J	M	20. A bride's personal outfit, as of clothes, jewelry, etc. E G M T
6. Time that is to come. B D	F	21. Memoirs of one's life written by oneself. A F K S
7. The sixtieth part of an hour. L M N	O	22. A thickly populated street marked by wretched living conditions. F G J S
8. Explanation of the meaning of a word. A B D F	J	23. A child in the first period of life. G H I L
9. A fastening, as for a door, operated by a key. C G I	L	24. A human head represented sidewise. H N P R
10. A period of one hundred years. B C D	F	25. A roundabout way temporarily replacing part of a route. C D G
11. A fluid preparation, as of the essence of flowers, used for scenting. M P R	U	26. A person who retires from society and lives in solitude. B D F
12. A seat for a rider on a horse's back. C D J	R	27. One who performs daring gymnastic feats. A E I O
13. A missile, usually of lead, to be shot from a small firearm. A B D	H	28. The official residence of a sovereign. D E J O
14. A small elementary book for teaching children to read. D F K	L	29. A first public appearance, as of an actor. A C D H
15. An enclosing border of a picture. A C D	F	30. One who travels to some holy place as a devotee. A F H
	I	P M P

COMPLETION

Then mark the first letter of that word on the answer sheet.

31. One who enters into, or offers himself for, any service of his own free will. D K U V

32. A three-wheeled vehicle propelled by pedals. D N N T W

33. The long projecting nose of a beast, as of swine. L S R V

34. An instrument used for looking out over the water from a submerged submarine. A G N P W

35. A person, animal, or plant that has reached maturity. I C N T

36. An imaginary circle dividing the earth's surface into the northern and southern hemispheres. A B D E F

37. A distinguishing mark, device, or symbol used on merchandise. A G J T V

38. A lure to catch fish or other animals. B J K O V

39. The working room of a painter or sculptor. C J K P S

40. A glass in one compartment of a window frame. C H P T

41. A visible mass of fog or haze suspended at a height in the air. B C G L O

42. The malicious burning of property. A E K O U

43. Prolonged inability to obtain due sleep. G H I J

44. Recovery, especially gradual recovery, of health after sickness. A B C D E

45. A unit of weight for precious stones, especially diamonds and pearls. A C H N T

46. A very large funnel used as a speaking trumpet. E J

47. The natural abode of an animal or plant. B H I J

48. One without means except such as come from charity. A K P U

49. The spirit, usage, or manners of knighthood. A C D I

50. One who is inclined to put the least favorable construction upon actions and happenings. H J P R S

51. A kind of very large nail. C I S U W

52. A light spear for hurling. C F H J K

53. The resistance to motion between two surfaces in contact. B C D E F

54. A specified or regular course of study. C M N O T

55. A short fictitious narrative from which a moral or spiritual truth is drawn. G H N P U

56. A small shrill flute. E H J M P

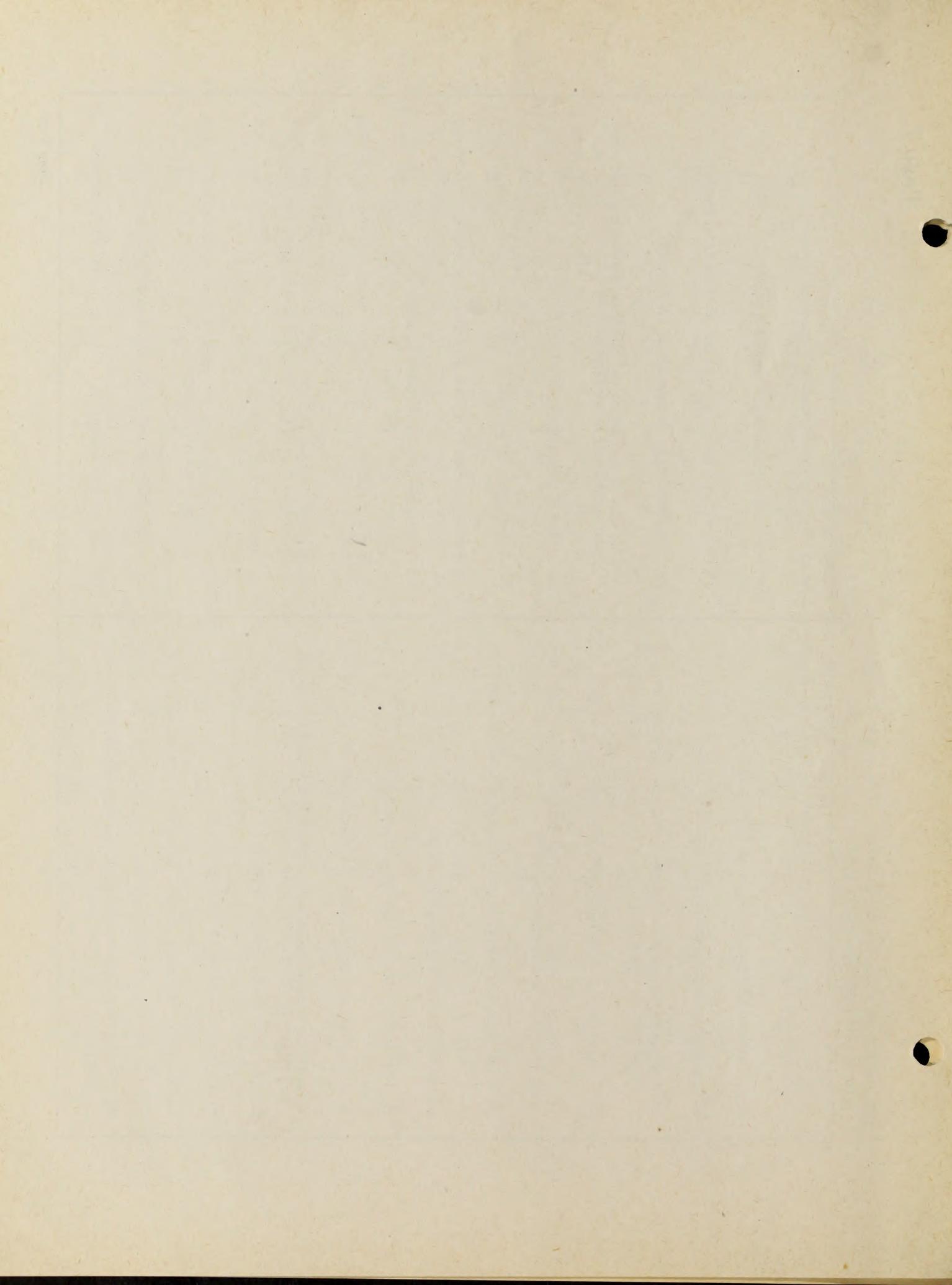
57. One who works in stone. D F M R Y

58. A representation of the outlines of an object filled in with some uniform color. G L N S W

59. A soft pillow or pad to rest on or against. A C F L O

60. The mass of leafage of a plant as produced in nature. A E F R

Stop here.



Arithmetic

PRACTICE PROBLEMS

In this test you will be given some problems in arithmetic. After each problem there are five answers, but only one of them is the correct answer. You are to solve each problem and blacken the space on the answer sheet which corresponds to the answer you think is correct. The following problem is an example.

1. How many pencils can you buy for 50 cents at the rate of 2 for 5 cents?
 (a) 10 (b) 20 (c) 25 (d) 100 (e) 125

Find on the answer sheet the space labeled "ARITHMETIC, Practice Problems, Page 9." The correct answer to the problem is 20, which is answer (b).

In the row-numbered 1, space (b) has been blackened.

In the *second* row, blacken the space which corresponds to the answer to the second practice problem.

2. If James had 4 times as much money as George, he would have \$16. How much money has George?
 (a) \$4 (b) \$8 (c) \$12 (d) \$16 (e) \$64

You should have blackened space (a), which corresponds to \$4, the correct answer.

Blacken the spaces corresponding to the answers to the following problems:

3. In 5 days Harry has saved a dollar. What has his average daily saving been?
 (a) 20¢ (b) 22½¢ (c) 25¢ (d) 30¢ (e) 40¢

4. John sold 4 magazines at 5 cents each. He kept $\frac{1}{2}$ the money and with the other $\frac{1}{2}$ he bought papers at 2 cents each. How many did he buy?
 (a) 3 (b) 4 (c) 5 (d) 6 (e) 10

When the signal is given (not yet), turn the page and work more problems of the same kind. Work rapidly and accurately. Your rating will be the total number of correct answers. You may not be able to finish in the time allowed.

Stop here. Wait for the signal.

Find the correct answer to each problem below. Then blacken the corresponding space on the answer sheet.

ARITHMETIC

1. Twelve girls rented a cottage for 3 months at \$40 per month. What was the total rent paid by each girl?
 (a) \$3.33 (b) \$9.00 (c) \$10.00 (d) \$12.66 (e) \$120.00
2. If $3\frac{1}{2}$ tons of coal cost \$21, what will $7\frac{1}{2}$ tons cost?
 (a) \$9.80 (b) \$42 (c) \$45 (d) \$75 (e) \$98
3. A has \$320, B has $\frac{1}{4}$ as much as A, and C has $\frac{1}{2}$ as much as A and B together. How much have all together?
 (a) \$400 (b) \$480 (c) \$500 (d) \$520 (e) \$600
4. A tank which holds 260 gallons of oil is $\frac{1}{4}$ full. How many gallons of oil are needed to fill the tank?
 (a) 65 (b) 195 (c) 200 (d) 205 (e) 220
5. A boy walked for $2\frac{1}{4}$ hours. He started at 10 minutes to 9 o'clock. When did he finish?
 (a) 10:35 (b) 11:05 (c) 11:20 (d) 11:55 (e) 12:05
6. Ray raised 60 heads of cabbage averaging 5 pounds each. He sold them at \$.03 a pound. He spent \$1.25 for plants and \$.58 for fertilizer. What was his profit?
 (a) \$6.17 (b) \$6.67 (c) \$7.17 (d) \$7.27 (e) \$7.87
7. If it takes 8 barrels of oil at \$1.35 per barrel to sprinkle $\frac{1}{2}$ mile of road, how much will oil cost for 5 miles?
 (a) \$27 (b) \$54 (c) \$81 (d) \$90 (e) \$108
8. In a fort there are 60 men and enough food to keep the 60 men for 20 days. If 20 new men come and 40 of the first go, how many days will the food last?
 (a) 10 (b) 20 (c) 30 (d) 40 (e) 60
9. A grocer bought 160 boxes of berries. From the first 8 boxes examined he had to throw away 1 box. At this rate, how many boxes will he be able to sell?
 (a) 20 (b) 21 (c) 120 (d) 139 (e) 140
10. A U-boat makes 8 miles an hour under water and 15 miles an hour on the surface. How many hours will it take to cross a 100-mile channel, if it has to go $\frac{2}{5}$ of the way under water?
 (a) 4 (b) 5 (c) 6 (d) 8 (e) 9

11. Two carpenters received \$150 for the work they did on a house. One worked 20 days and the other 30 days. How much more did one get than the other?
 (a) \$30 (b) \$35 (c) \$40 (d) \$45 (e) \$50
12. Soldiers march 2 feet 6 inches per step and take 100 steps to the minute. How many feet do they march in $\frac{1}{2}$ of an hour?
 (a) 1000 (b) 1250 (c) 1320 (d) 1500 (e) 1600
13. If $\frac{2}{3}$ of a yard of silk costs \$3, how many yards can be bought for \$22.50?
 (a) 4 (b) 5 (c) $5\frac{1}{2}$ (d) $5\frac{2}{3}$ (e) $7\frac{1}{2}$
14. John has 4 times as many marbles as James, and together they have 75 marbles. If Henry buys $\frac{1}{6}$ of John's marbles and $3\frac{1}{3}$ per cent of James', how many will he gain?
 (a) 10 (b) 12 (c) 15 (d) 17 (e) 23
15. The average person attends school 1,080 days. What part of a 12-year course does he complete, counting 180 days as a school year?
 (a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{5}{8}$ (d) $\frac{2}{3}$ (e) $\frac{3}{4}$
16. A fruit dealer buys 10 dozen oranges for \$2.40. If two dozen spoil, at what price per dozen must he sell the good ones to gain $\frac{1}{3}$ of the whole cost?
 (a) \$.20 (b) \$.25 (c) \$.30 (d) \$.33 (e) \$.40
17. If a fowl loses $\frac{1}{3}$ in dressing, how many pounds of undressed fowl will be necessary to dress 9 pounds?
 (a) 12 (b) $12\frac{1}{2}$ (c) $13\frac{1}{2}$ (d) 15 (e) 18
18. A can do a piece of work in 8 days, while B would take 20 days. After A has worked alone for 3 days, how many days will it take B to finish the work?
 (a) 8 (b) 9 (c) 10 (d) 12 (e) $12\frac{1}{2}$
19. Five lamp posts are placed along a street 35 yards apart. How many yards is the first lamp post from the last?
 (a) 95 (b) 140 (c) 175 (d) 420 (e) 525
20. If $\frac{3}{4}$ of A's money equals $\frac{1}{2}$ of B's money, and they have \$40 together, how much has A?
 (a) \$8 (b) \$10 (c) \$12 (d) \$16 (e) \$24

Stop here.

Number Series

PRACTICE PROBLEMS

The numbers in each series proceed according to some rule. For each series you are to find the *next number*.

In the first series below, each number is 2 larger than the preceding number. The *next number* in the series would be 14. Of the five answers at the right, answer (e) is, therefore, correct. In the section of the answer sheet labeled "NUMBER SERIES, Practice Problems, Page 11," space (e) in the first row has been blackened.

	<i>Series</i>						<i>Next Number</i>				
1.	2	4	6	8	10	12	10	11	12	13	14
							(a)	(b)	(c)	(d)	(e)

Find the rule in the series below, and blacken one of the answer spaces in the second row on the answer sheet.

2.	20	19	18	17	16	15	10	12	14	15	16
							(a)	(b)	(c)	(d)	(e)

Each number in this series is 1 less than the preceding number. You should have blackened space (c), which corresponds to 14, the next number in the series.

Find the rule in the series below, and blacken the space on the answer sheet which corresponds to the next number.

3.	10	8	11	9	12	10	9	10	11	12	13
							(a)	(b)	(c)	(d)	(e)

The series above goes by alternate steps of subtracting 2 and adding 3. You should have blackened space (e), which corresponds to 13, the next number.

In each series below, find the rule and blacken the space on the answer sheet which corresponds to the next number. There is a different rule for each series. Go right ahead. Do not wait for any signal.

4.	8	11	14	17	20	23	10	13	23	25	26
							(a)	(b)	(c)	(d)	(e)
5.	27	27	23	23	19	19	15	16	17	18	19
							(a)	(b)	(c)	(d)	(e)
6.	16	17	19	20	22	23	18	20	22	24	25
							(a)	(b)	(c)	(d)	(e)

When the starting signal is given (not yet), turn the page and work more problems of the same kind. Work rapidly because your rating will be the total number of correct answers. You may not be able to finish in the time allowed.

Stop here. Wait for the signal.

Find the rule in each problem below and blacken the space which corresponds to the next number.

NUMBER SERIES

1. 14 18 22 26 30 34 38 (a) (b) (c) (d) (e)	39 40 41 42 43 (a) (b) (c) (d) (e)	16. 100 90 81 73 66 60 55 (a) (b) (c) (d) (e)
2. 7 10 9 12 11 14 13 (a) (b) (c) (d) (e)	12 14 16 18 20 (a) (b) (c) (d) (e)	17. 12 6 8 16 14 7 9 (a) (b) (c) (d) (e)
3. 17 20 23 26 29 32 35 (a) (b) (c) (d) (e)	36 37 38 39 40 (a) (b) (c) (d) (e)	18. 4 8 9 18 22 23 46 (a) (b) (c) (d) (e)
4. 8 12 11 15 14 18 17 (a) (b) (c) (d) (e)	16 18 20 21 24 (a) (b) (c) (d) (e)	19. 40 42 21 24 8 12 3 (a) (b) (c) (d) (e)
5. 20 18 21 17 22 16 23 (a) (b) (c) (d) (e)	9 12 15 21 24 (a) (b) (c) (d) (e)	20. 9 12 8 10 13 9 11 (a) (b) (c) (d) (e)
6. 72 36 40 20 24 12 16 (a) (b) (c) (d) (e)	4 8 12 16 20 (a) (b) (c) (d) (e)	21. 40 33 27 21 16 11 7 (a) (b) (c) (d) (e)
7. 8 6 4 12 10 8 16 (a) (b) (c) (d) (e)	6 10 12 14 16 (a) (b) (c) (d) (e)	22. 4 5 7 4 8 13 7 (a) (b) (c) (d) (e)
8. 2 4 12 14 42 44 132 (a) (b) (c) (d) (e)	133 134 260 268 396 (a) (b) (c) (d) (e)	23. 44 40 42 14 10 12 4 (a) (b) (c) (d) (e)
9. 82 73 64 55 46 37 28 (a) (b) (c) (d) (e)	14 18 19 20 27 (a) (b) (c) (d) (e)	24. 2 3 5 5 10 11 13 (a) (b) (c) (d) (e)
10. 0 1 3 6 10 15 21 (a) (b) (c) (d) (e)	23 25 28 29 30 (a) (b) (c) (d) (e)	25. 20 2 12 60 6 16 80 (a) (b) (c) (d) (e)
11. 4 5 6 7 5 6 7 (a) (b) (c) (d) (e)	3 6 7 8 9 (a) (b) (c) (d) (e)	26. 4 6 3 7 9 6 10 (a) (b) (c) (d) (e)
12. 18 20 17 21 16 22 15 (a) (b) (c) (d) (e)	8 17 21 23 30 (a) (b) (c) (d) (e)	27. 10 6 24 28 7 3 12 (a) (b) (c) (d) (e)
13. 8 9 12 13 15 16 19 (a) (b) (c) (d) (e)	17 20 21 23 24 (a) (b) (c) (d) (e)	28. 7 9 12 8 3 9 16 (a) (b) (c) (d) (e)
14. 20 16 8 24 20 10 30 (a) (b) (c) (d) (e)	15 23 26 28 90 (a) (b) (c) (d) (e)	29. 95 92 46 42 21 16 8 (a) (b) (c) (d) (e)
15. 7 4 12 15 5 2 6 (a) (b) (c) (d) (e)	0 1 5 6 9 (a) (b) (c) (d) (e)	30. 9 3 8 4 7 5 6 (a) (b) (c) (d) (e)

Stop here.

Directions for Administering the Minnesota Speed of Reading Test

1. Before the tests are given to the pupils, the examiner says: "The purpose of this test is to measure the rate at which you read. Do not turn any of the pages nor write on the test until further directions are given."
2. Pass the tests to the pupils.
3. After each pupil is supplied with a copy of the test say: "Write your name in the space provided. Be sure to write your last name first, then your first name and then your middle name. Fill in the remaining spaces as indicated." (Allow time for completing this task.) "Now read the directions for this test and do what they tell you. Do not turn the page until you are given the signal."
4. Allow ample time for the reading of the directions.
5. "Are there any questions concerning the directions?"
6. Answer such questions as may be asked.
7. "You will be given six minutes for this test. Work rapidly and carefully until the signal 'stop' is given."
8. "Ready! Go!" (Allow exactly 6 minutes.)
9. "Stop!"
10. Collect all tests immediately.

Directions for Scoring the Minnesota Speed of Reading Test

1. Credit of one point is given for each paragraph that is correct.
2. A paragraph is considered correct if the absurd phrase, as given in the key, is crossed out.
3. A paragraph is considered correct if any part of the phrase which should be crossed out is crossed out by the student, providing the mark does not extend beyond the phrase.
4. A paragraph is considered wrong if more than the phrase is crossed out. If, however, the pencil mark has extended through part of the word which follows the phrase or starts in the word which precedes the phrase, the paragraph is counted correct. In other words this is considered as a slip of the pencil.

Key for Scoring

Minnesota Speed of Reading Test for College Students

Form A

The phrases that should be crossed out are as follows:

1. under the guidance of the grocery clerk
2. under the control of the professional baseball league
3. who always serves as a janitor
4. which are turned out in a sawmill
5. which results from indigestion
6. because the flowers have not been watered
7. under the able leadership of Julius Caesar
8. which is found in abundance in the coal mines of the East
9. by using steel beams

10. an African bushman
11. which is adapted to the feeble-minded
12. in our ability to run automobiles
13. for the construction of airplanes
14. for the right to use private lounging rooms
15. by parcel post
16. generated by Niagara Falls
17. who were three months old
18. which depended upon the peanut crop
19. for janitors and waitresses
20. unless he is president of the United States
21. by airplane
22. who is always of Mexican descent
23. of the National Cash Register Company
24. among plants and animals
25. who float in air
26. in spreading scarlet fever germs
27. under the direct auspices of the woman's club
28. which were organized after his death
29. which should be cut off
30. who were reared in America
31. an exact duplicate of the constitution of the United States
32. warfare of
33. ninety years old
34. in which German alone is taught
35. which consists of the sun and the moon
36. among microbes and insects
37. Grand Duke of California
38. Development of Kodak films by

Norms for Minnesota Speed of Reading Test

Form A

The norms given below have been obtained by giving Form A of the Minnesota Speed of Reading Test to a group of college sophomores and juniors at the University of Minnesota. The percentile scores may be defined as the percent below plus one-half of those reaching a given score. For example, the score of 30 has a percentile rank of 94 which indicates that the number of cases falling below the score of 30 plus one-half of those at this score equals approximately 94½ of the group tested. The scale values are in terms of tenths of standard deviations with an arbitrary zero point located at five standard deviations below the median and the median point represented by 50.0. Since the score of 14 has a scale value of 40.0, it is exactly one standard deviation below the median. The chief advantage of these scale values lies in the fact that the units are equal at all points of the scale.

Raw Score	Percentiles	Scale Values	Raw Scores	Percentiles	Scale Values
36	99.70	77.5	18	39.88	47.5
35	99.41	75.0	17	34.52	46.0
34	98.81	72.5	16	27.68	44.0
33	97.62	70.0	15	21.43	42.0
32	96.43	68.0	14	15.48	40.0
31	95.24	66.5	13	11.90	38.0
30	94.05	66.0	12	9.23	37.0
29	92.86	64.5	11	6.55	35.0
28	91.67	64.0	10	5.95	34.5

Raw Score	Percentiles	Scale Values	Raw Scores	Percentiles	Scale Values
27	89.09	62.0	9	5.36	34.0
26	86.61	61.0	8	4.76	33.0
25	84.23	60.0	7	4.17	32.5
24	80.66	58.5	6	3.27	31.5
23	76.79	57.5	5	2.08	29.5
22	71.43	55.5	4	1.19	27.5
21	63.69	53.5	3	1.19	27.5
20	53.87	51.0	2	.89	26.0
19	44.94	48.5	1	.30	22.5

Grade Norms for the Minnesota Speed of Reading Test

Form A

<u>Grade</u>	<u>Md.</u>	<u>Q3</u>	<u>Q1</u>
College Graduates	23.5	28.3	18.5
College Juniors	22.6	26.1	19.2
12th Grade	18.4	20.8	14.1

Key for Scoring

Minnesota Speed of Reading Test for College Students

Form B

The phrases that should be crossed out are as follows:

1. or a professional prize fight
2. the distance between the earth and the moon
3. which is made of rubber fibers
4. commits murders
5. the sandy shore at the beach
6. as quoted from Shakespeare
7. which deal with the manufacturing of automobiles
8. who inhabited Mars
9. and the overflowing Mississippi
10. foster cruelty among dumb animals
11. who are under sixteen years of age
12. who became steam-fitters
13. hidden in the untouched coal mines
14. without children
15. lawyers and doctors
16. who live in Germany
17. found among the white rats
18. in the style of automobiles
19. in the trunk of the trees
20. because of his incoherent speech
21. by the United States legislature
22. in aircrafts

- 23. when buried underground
- 24. of blackberries
- 25. for he saw no Fordson tractors
- 26. which depend upon a knowledge of weather conditions
- 27. much snow fell in winter
- 28. located in New York City
- 29. used in the construction of dog kennels
- 30. which is compared to a cat
- 31. with interest compounded annually
- 32. than the scales show
- 33. with pencil or pen
- 34. and aviator
- 35. of collecting stamps
- 36. which do not use roads
- 37. of uncivilized man
- 38. in the United States

Norms for Minnesota Speed of Reading Test

Form B

The norms for Form B of the Minnesota Speed of Reading Test are interpreted in the same manner as those for Form A.

Raw Scores	Percentiles	Scale Values	Raw Scores	Percentiles	Scale Values
37	99.64	77.0	21	60.07	52.5
36	98.92	73.0	20	53.96	51.0
35	98.56	72.0	19	44.60	48.5
34	98.20	71.0	18	36.33	46.5
33	97.48	69.5	17	30.58	45.0
32	96.40	68.0	16	23.02	42.5
31	95.32	67.0	15	16.55	40.5
30	94.60	66.0	14	13.67	39.0
29	94.24	66.0	13	11.51	38.0
28	93.16	65.0	12	8.63	36.5
27	91.73	64.0	11	5.76	34.0
26	90.65	63.0	10	3.96	32.0
25	89.93	62.5	9	2.52	30.5
24	79.86	58.5	8	1.08	27.0
23	72.30	56.0	7	.72	25.5
22	65.11	54.0	6	.36	23.0

Grade Norms for the Minnesota Speed of Reading Test

Form B

Grade	Md.	Q ₃	Q ₁
College Graduates	25.3	30.9	20.4
College Juniors	26.8	30.5	23.9
12th Grade	21.0	23.6	17.6

MINNESOTA SPEED OF READING TEST
FOR
COLLEGE STUDENTS

FORM B

ALVIN C. EURICH, Ph.D.
Professor of Education, Stanford University

Name _____ Sex _____
Present Address _____ Age _____
High School _____ City _____ State _____
College Classification _____ Date _____

DIRECTIONS

Read the directions and do what they say.

1. A number of selected paragraphs are printed within this folder. Each paragraph is printed as the example below:

The Chinese appear to have manufactured paper from a very remote period—possibly as early as the second century B.C. Sometime during the eighth century A.D. the Arabs who inhabited Chicago, Illinois, became acquainted with the process through Chinese war prisoners.

2. You are to read the paragraph. In so doing you will note that an absurd statement has been inserted which has no relation to the meaning of the rest of the paragraph.

3. You are to draw a line through the absurd state-

ment or phrase. In the paragraph above, the absurd statement is: "who inhabited Chicago, Illinois." Draw a line through this entire phrase. Do it! The paragraph now reads as it should.

4. On the following pages read each paragraph as you come to it. As soon as you have found the absurd phrase or statement, cross it out and go on to the next paragraph.

5. When the signal "go" is given *and not before* turn over the page. Begin with the first paragraph. Go on to the remaining paragraphs in the order given. Do not skip about. This is a test of your rate of reading, therefore work rapidly but carefully. When the signal "stop" is given do not make any more marks on the paper.

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1. There is a tendency to enforce compulsory laws more rigorously than has been done in the past. Some States have recently enacted laws which will make it practically impossible for any boy or girl of school age to be absent from school or a professional prize fight except for sickness.
2. Although all states must possess the essential requisites of territory, population, unity, and sovereign organization, they nevertheless differ widely in respect to the extent of their territory, the number of the population, the distance between the earth and the moon, and the peculiar nature of their organization.
3. To plan a theme is merely to think it out beforehand, as any good workman thinks out a job before attempting to go on with it. The thinking out of a composition which is made of rubber fibers is simple enough as soon as one becomes accustomed to doing it.
4. But what is education? Of course it is not book learning. Book learning does not make five per cent of that mass of common sense that "runs" the world, transacts its business, secures its progress, trebles its power over nature, commits murders, wears away the world's restraints, and lifts off its burdens.
5. Approximately two-thirds of the pupils who enter the first grade of the public high school leave school before the close of the course. About one-third of those who enter leave the sandy shore at the beach during the first year or before the beginning of the second year.
6. Intermediate industrial schools are those designed to take children at or near fourteen years of age and to give them the beginnings of vocational training for groups of related occupations, or for specialties. They do not assume to give trade training as quoted from Shakespeare, but a practical preparation therefor.
7. Advance in physical and biological sciences during future decades will certainly prove as helpful as at any previous time. But the most fruitful researches during the twentieth century will probably be conducted not in the natural sciences which deal with the manufacturing of automobiles but in the social sciences.
8. On looking back we find that the immediate cause of the rise of capitalism was the amassing of coined money. The deeper cause lay in the increase of international relations by means of which peoples of the early capitalistic phase who inhabited Mars were united into a higher form of economic co-operation.
9. Egypt is a land with a long history; a land with which we associate Joseph and Moses and the children of Israel; the land of the Sphinx and the pyramids and the overflowing Mississippi.

It has had many conquerors and many owners. It is essentially an independent country.

10. Every year at Christmas the United States mail is full of letters, packages, and boxes to which Red Cross stamps have been affixed. From the sale of the stamps, money is derived to foster cruelty among dumb animals and prevent tuberculosis. Their presence is due to the influence of Clara Barton.
11. Records show that the tenure of the average teacher is very short. Many reasons account for this condition. Perhaps the most potent reason is that a vast majority of the teachers are women and a large number of them who are under sixteen years of age get married and quit the schoolroom.
12. It is a significant fact that liberal education has attained its profoundest development under the auspices of the State. As long as society in its corporate capacity refused to interfere in this field, liberal education was a matter for the select few who became steam-fitters—the so-called leisure class.
13. The right of the general body of people to vote for representatives to govern them is the corner stone of the free institutions of Great Britain and America. The origin of this representative government lies hidden in the untouched coal mines at the very beginning of Anglo-Saxon institutions.
14. We are becoming convinced that we must require our pupils to spend more time each year in school than has been the practice heretofore; so we have gradually extended the school year until now plans are being formed in some places for the establishment of an all-year school without children.
15. Eugenic marriage laws, as they are called, have been passed by several states. In general they require a certificate of sound health and freedom from disease. Before them there were laws forbidding marriage between certain mental defectives such as idiots, imbeciles, lawyers and doctors, and those otherwise mentally diseased.
16. While Italian, Greek, and Spanish boys become adolescent at twelve to fourteen and Scandinavian boys at fourteen to sixteen, the mixed nationalities in America show an average age of onset of about fourteen, and a large proportion of American boys who live in Germany enter puberty during the fourteenth year.
17. Good physical condition is of the greatest importance for study. Fairly healthy individuals are more prone to neglect this phase of life than those who are definitely sick. Hundreds of little ailments and dissipations found among the white

rats prevent the human organism from being one hundred per cent efficient.

18. The most significant changes in the history of Western education were the invention of the movable type, the perfecting of the art of making paper and their combined use in the publication of books. This momentous change in the style of automobiles occurred at the middle of the fifteenth century.
19. What makes the heart beat? No one as yet understands life sufficiently to give a satisfactory answer to this question, but we do know that most activities are brought about at the command of the brain; most of the muscles in the trunk of the tree will not contract at all unless it orders them to do so.
20. Many inventions owe their existence to a mere hint. Genius often uses a suggestion to make a great achievement. It is on the alert for such things. Eli Whitney was alert for new ideas all of his life. He was called a genius because of his incoherent speech even in his boyhood.
21. There was a law in Athens which gave to its citizens the power of compelling their daughters to marry whomsoever they pleased; for upon a daughter's refusing to marry a man her father had chosen, the father was empowered by the United States legislature to put her to death.
22. Personally Taft is kindly, unaffected, democratic, full of good humor, courageous. As a public officer he was slow and judicial rather than quick and executive like his predecessor. Although in sympathy with the reforms instituted by Roosevelt, Taft was less the reformer in aircrafts and more conscious of the considerations of constitutionality.
23. Practical electromagnets were made in 1831 by Joseph Henry, a famous American schoolmaster and scientist, then teaching in the academy at Albany, N. Y. and by Faraday in England. Henry's magnet was capable of supporting fifty times its own weight when buried underground which was considered very remarkable at that time.
24. The most concrete example of effective social co-operation is to be found in the evolution of the mechanical arts. For generations men have been inventing and perfecting tools, and through the use of tools they have transformed in a very large measure of blackberries the world in which they live.
25. It was on Friday morning, the 12th of October, that Columbus first beheld the New World. As the day dawned, he saw before him a level island, several leagues in extent and covered with trees like a continual orchard. Though apparently uncultivated, for he saw no Fordson tractors, it was populous.
26. With the possible exception of a few special-type schools practically every secondary school in the United States includes algebra and plane geometry in its program of studies and in most schools those subjects which depend upon a knowledge of weather conditions are rigidly prescribed for the majority of pupils.
27. In a comparatively brief period Prussia changed from an agricultural country to a country whose chief wealth was in its industrial enterprises. New capital flowed in for development purposes; business expanded; the mineral wealth was prospected and its mining actively begun; much snow fell in winter and railways were actively extended.
28. In 1492 the Jews were expelled from Spain and in the next century in most European countries they were compelled to live in separate quarters of the towns where they resided. Herded in these ghettos they made the synagogue located in New York City the center of Jewish life.
29. Another form of thinking which is common is that in which the thinker, having perceived that some general truth, statement, or principle bears on some particular fact or set of facts, points out this bearing or application. The process is direct, used in the construction of dog kennels and helpful.
30. As in the individual so in the social body, self-government is the word which expresses the healthy state of manhood. Nations, like individuals, go through their successive stages of infancy, boyhood, and pupilage; but a grown man requires no tutors and a grown nation which is compared to a cat no governors.
31. In thinking we proceed either by induction or else by deduction. A composition in which arguments or facts are in the first instance in the nature of particulars and details, and later used to lead up to a more general fact, or principle with interest compounded annually, proceeds by induction.
32. Suggestions come best from those who are admired or respected. The weak teacher who says that he expects his boys to behave like gentlemen is likely to be regarded as only coaxing them. A teacher who is respected will convey such a suggestion with much greater weight than the scales show.
33. One of the social qualities much desired by youth and adults and admired by all, even in children, is that of leadership. It is possessed by different individuals in very different degrees. Even in childhood some possess natural qualities which mark them out with pencil or pen as leaders—even in mischief.

34. The results of the long struggle of the English for liberty under law showed itself in many ways in the growth of tolerance among the people of the English nation. At a time when other nations were bound down in blind obedience to king and aviator, the English people were accustomed to liberty.
35. The great man in commerce today is the co-operative man, the man who sees clearly the right thing to be accomplished and is willing to sink his individuality to accomplish it; the man who is more interested in the job of collecting stamps than in getting credit for doing it.
36. Although the improvement of highways is chiefly due to demands of the motor cars they ease the labour of the surviving horses. The automobiles wear out the roads more than do the horse-drawn vehicles which do not use roads, but they also contribute heavily to the government revenues.

37. The judicial branch of government, though less numerous than the executive, occupies a position no less important in the organization of the state. The prime function of the judiciary performed in all states, is to decide upon the application of the existing law of uncivilized man in individual cases.
38. The present kingdom of Denmark is only a remnant of a once larger and more influential nation. At times in the past Denmark has been one of the leading powers in the United States, and it still occupies a strategic position, for it controls the ocean route between the North and Baltic Seas.

MINNESOTA SPEED OF READING TEST
FOR
COLLEGE STUDENTS

FORM A

ALVIN C. EURICH, Ph.D.

Professor of Education, Stanford University

Name _____ Sex _____

Present Address _____ Age _____

High School _____ City _____ State _____

College Classification _____ Date _____

DIRECTIONS

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1. A number of selected paragraphs are printed within this folder. Each paragraph is printed as the example below:

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1. The older the school pupil becomes, the stronger is the force of those economic and social influences which ultimately will remove him from the school. Up to the age of fourteen the public schools hold the pupils well aided by the compulsory attendance laws under the guidance of the grocery clerk.
2. The principles underlying modern education may be said to have had their beginning in the eighteenth century reforms of Rousseau, Pestalozzi, Froebel, and Herbart. At this time the schools were controlled by the church, which also to a very large extent dominated the state under the control of the professional baseball league.
3. The term "executive" is used to designate those officers of the government whose business it is to carry out the law of the land. In the narrower sense it often signifies merely the supreme head of the administration who always serves as a janitor, or the same person together with his chief subordinates.
4. The man who succeeds must think, and the man who thinks must get his thought clear in his own mind. To define his thought clearly to himself, he must put it accurately into words—language. To use language accurately, he must learn what words, which are turned out in a sawmill, mean.
5. Recent studies have shown that feeble-mindedness is one of the important causes of permanent delinquency. Goddard has shown that mental defect is hereditary in perhaps sixty-five to seventy-five per cent of the cases. If his estimate is correct, feeble-mindedness which results from indigestion is largely an hereditary factor.
6. The life of a dry cell battery is not fixed but depends on the circuit in which it is used. Oftentimes dry cells which are merely standing on a shelf for a year without being used at all will dry up because the flowers have not been watered and become practically useless.
7. The life ambition of Emma Hart Willard was to organize a system of education for women which should possess the same permanency, uniformity, and respectability as educational institutions for men, and yet should so differ as to be adapted under the able leadership of Julius Caesar to the needs of women.
8. During the unprecedented scientific development of the past half century, there have frequently arisen certain technical tendencies on the part of men of science which have caused many non-scientific persons to misunderstand the real nature of scientific truth which is found in abundance in the coal mines of the East.
9. One of the most natural ways of thinking is that in which, as soon as one makes an assertion, he recalls individual instances in which it has proved true; in other words, examples of the fact asserted. Therefore, this method of building up thought by using steel beams is common.
10. Prolonged studies of the origin of very gifted children in this country have been confined largely to cities. They have shown repeatedly that the great majority of these children originate in families where the father is a professional man, an African bushman, or an owner or executive in business.
11. Constant pressure is being put upon pupils to continue in school for full time after completing the elementary school curriculum. With a view to facilitating the transition from the elementary to the high school, the junior high school which is adapted to the feeble-minded is being widely established.
12. Perhaps it might seem to be claiming too much to insist upon certain points of similarity between us and the Greeks of old. The points of dissimilarity are only too evident to most of us, and yet there is a likeness in our ability to run automobiles as well as an unlikeness.
13. Rome's institutions as she developed them remained those of a city. It was difficult to apply them to the vast territory she attempted to govern with their aid. They were clumsy institutions which functioned irregularly and proved a system for the construction of airplanes that could not and did not last.
14. With the widespread extension of good roads has come a very rapid growth of transportation by motor trucks and motor busses which usually pay only a small license fee for the right to use private lounging rooms, and which derive profit from the carrying of freight and passengers.
15. Among all the sorrows of this war there is one joy for us in it: that it has made us brothers with the French as no two nations have been brothers before. After ages of conflict there has come to us by parcel post a kind of a millennium of friendship.
16. The English colonies on the Atlantic seaboard, occupied with their own problems of developing their agricultural resources, building up their commerce, defending their precious rights of self-government against king and proprietor, were slow to realize the serious meaning of the French power generated by Niagara Falls which was gradually surrounding them.
17. Early types of vocational education were especially strong in the practical aspects of the subject and weak in the more abstract phases. The home, farm, and shop have always provided an abundance of practical tasks and examples whereby to teach boys and girls who

were three months old the simple vocational arts.

18. When commerce advanced, industry did not stand still. To satisfy the demands of a growing number of customers all over the world production must be increased. But that could not be done without changes both in the method of manufacture which depended upon the peanut crop and its organization.
19. Notwithstanding Spanish indifference and monastic opposition, the Filipinos have opened elementary schools in almost every village. They have also founded high schools and university colleges throughout the archipelago, and a university and two large normal schools for janitors and waitresses, and five large schools for women in Manila.
20. The compulsory school age is being extended quite generally throughout our country. In many sections a boy or girl must be in school for full time until fourteen years of age, and part time from fourteen to sixteen unless he is president of the United States, or even eighteen years of age.
21. It is generally held among historians that the first appearance of our cultural ancestors upon the soil of Western Europe occurred about 2000 B.C. At that time a group of tribes, admitting kinship to common origin, came down out of the grassland of central Asia by airplane and overran the peninsula.
22. Of all important countries, France possesses the most highly centralized form of educational control and administration. In that country, the entire system of public education is under the charge of the Minister of Public Instruction and Fine Arts who is always of Mexican descent and of his subordinate officials or bureaus.
23. A simple and convenient starting point may be found in the statement that political science deals with government. The word "government," used in its widest sense, rests on the fundamental idea of control and obedience; it implies authority of the National Cash Register Company, and a submission to that authority.
24. The American democracy depends for its existence and success on the social consciousness and social co-operation of its citizens. Unless the school can make a significant contribution to the development of social consciousness and social co-operation among plants and animals, it must fail in one of its most important purposes.
25. Until the world learns what it means to pull together with other people, we shall never have the realization of the real patriot. And we will never learn to pull together as long as we are taught that one of us who floats in air is worth half a dozen others.
26. The condition of the child's health exercises considerable influence on his efficiency. Like their parents and teachers, children are less apt to be amiable and self-controlled when they are fatigued; and now the best schools and homes take every precaution in spreading scarlet fever germs to avoid unnecessary strain.
27. It is the specific purpose of this article to attempt to estimate what America's fundamental ideas about international co-operation are likely to be, and to consider how far under the direct auspices of the woman's clubs they are likely to be compatible with the views and necessities of Europe.
28. Jefferson was the most finished scholar of Revolutionary times, and he was always interested in education. He spent the later years of his life trying to improve the schools of Virginia which were organized after his death, and helping to establish the University of Virginia.
29. During the past two decades the methods of teaching in our schools have changed rapidly and profoundly. The critics of our schools think that our newer methods give children too much freedom, and especially that they substitute the use of the hand which should be cut off for the exercise of the brain.
30. In Ancient Greece the first lessons taught were the use of the instrument and the simple chants of the religious service. As soon as the pupil knew how to play, the master taught him to render the works of the great lyric poets of Greece who were reared in America.
31. Much of the Old Testament written in a Semitic language is poetry to compare with the Homeric poems, which are in the Indo-European languages. It further contains an account of the Hebrews and their relations with other states, an exact duplicate of the constitution of the United States, and a system of ritual.
32. Whatever the point of view from which we consider the study of composition, we should find its purpose always the same: to discipline us to think. And this purpose is indisputably one of the great purposes, if not the one great purpose, of carrying on warfare of education.
33. The key to any analysis of aims in education is to be found in an analysis of the activities of life in which people should or do engage. The aim of secondary education, therefore, must be interpreted in terms of the activities in which individuals ninety years old participate.
34. Recent attempts to secure a certain amount of standardization in college admission requirements have led to substantial agreement in defining those requirements in terms of "units." A unit represents a year's study in any subject

in a secondary school in which German alone is taught, constituting approximately a quarter of a full year's work.

35. There are two forces at work which determine the form of social organization, one set of forces tending to bind together the various parts of society and to unify it, the other set tending to separate the various parts of society which consists of the sun and the moon and to disrupt it.

36. Switzerland with ten million acres of mountains has cultivated rather efficiently the three and five-tenths per cent that seemed worth cultivating. She has been importing some food, but having little to exchange for food, excessive population increase among microbes and insects

on the products of other soils was denied her.

37. It happened in the eighteenth century that there were several remarkably intelligent monarchs—Frederick II of Prussia, Catherine the Great of Russia, Charles III of Spain, Emperor Joseph II and his brother Leopold, Grand Duke of California. These rulers read the works of reformers and planned many reforms for bettering existing conditions.

38. Much of the thinking we do consists in accumulating proof of things we have asserted or believe. Whenever we present a fact for the express purpose of showing the truth of something else—that this something else is so—we use the method of development of kodak films by presenting proof.

Manual of Directions of the STUDY-HABITS INVENTORY

Revised edition, 1941

By C. GILBERT WRENN

Author of *Studying Effectively*, *Study Hints for High School Students*, etc.

Assisted in the original edition by R. B. McKeown
and in the revision by Wilbur J. Humber

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THE USE OF THE INVENTORY

The *Inventory* is a weighted check list of specific study habits and attitudes which high scholarship and low scholarship groups of students possess in differing proportions. Such groups have been found to differ on these attitudes and habits even though they are the same on a number of other factors such as scores on scholastic ability tests, courses taken, and academic interests. By using the *Inventory* with high school seniors and college students, a counselor can assist students to recognize the particular habits which may be keeping them from attaining their best scholastic achievement. During the five years since the original *Inventory* was first published it has been used in many colleges and universities. The first edition has now been revised by more completely validating all of the items and by adding several new items.

The *Inventory* may be used in the following ways: it may be

1. Given to entering classes or other large groups of students in order to determine the particular study weaknesses that are most evident for the group as a whole, so that class work, remedial assistance, and counseling assistance can be provided with the proper emphasis in the educational program of the institution.

2. Given to classes or other groups of students and the scored *Inventories* returned to them individually so that each can see the particular habits which he needs to modify.

3. Given as a part of any comprehensive battery of tests the results of which are to provide the basis for clinical study and individual counseling. The specific nature of the *Inventory* items makes it particularly helpful as an introduction to counseling interviews upon study habits.

4. Given to classes of high school seniors for their own information as to the significance of the study habits they possess and as a basis for pre-college assistance and individual counseling on study habits.

During recent years the *Inventory* has been used in all of these ways. Those who have used it most say that it is particularly helpful in making students think of study habits in a specific rather than a general sense

and for motivating them to attack specific habits for development. It should go without saying that the college or university should assume responsibility for giving the students skilled assistance in remedying their habits of work once they have discovered which habits are faulty. The *Inventory* can be given in twenty minutes either in or out of class, and can be scored in from two to three minutes. If strict economy is desired, the scoring weights can be read by a teacher to a class or group of students and each student score his own. (A self-scoring form of the *Inventory* is published as part of a complete study-habits manual, *Studying Effectively*.) In scoring it is recommended that the items which secure negative scores be circled in red and the student instructed to note these as the habits that especially need attention. The scoring weights were derived from college men although the scoring key carries an indication of which habits of study are also discriminating for women.

It may be helpful to mimeograph an interpretation sheet and return it with the scored *Inventory*. This sheet might contain such statements as the following:

"This *Inventory* of your study habits has been scored and is being returned to you so that you can understand the relationship of your work-habits to scholarship.

"A negative score means that more students of low scholarship than of high scholarship have checked this item the way you did. The score is especially significant if your answer has been in columns 1 or 3. The size of the score is somewhat indicative of the importance of the habit. The habits which receive negative scores are the ones which may be associated with your failure to achieve your best scholarship record. Conversely, the positive scores, especially in columns 1 or 3, indicate that these habits are more characteristic of students who attain high scholarship records.

"Almost any habit can be changed by persistent effort. For any habit that might tend toward low scholarship there is an alternative habit that might help you achieve higher scholarship. Many helpful techniques and suggestions can be found in books or pamphlets on the subject. For suggestion of these or for direct help from some individual see your counselor or someone in your school whom he may suggest. Keep this *Inventory* and over a period of time try to correct your poor habits. To possess a poor habit of study is not nearly as unfortunate as to keep it.

"Do not place too much dependence upon the total algebraic-score. You may have a high positive total score and still have one or two very poor habits indicated by negative scores in columns 1 and 3. However, if your total score is below a plus 15, which is the average total score (median) of a large group of college freshmen, you certainly need to examine your individual scores with great care."

CONSTRUCTION OF THE INVENTORY

Many factors contribute to good academic achievement, such as general scholastic aptitude, subject-matter background, motivation or drive, and study habits and attitudes. It is these habits of work that determine the effectiveness of the other factors in the study situation. The *Inventory*

is the result of an effort to determine *which* habits and attitudes have the closest relationship to achievement when the other factors are controlled or held constant. It is not enough to say that a given principle of study is good because it sounds well or because it is logical to think that it should be effective. It is more important to determine its effectiveness under conditions in which other influences upon scholastic achievement are controlled. It has been found, for example, that students of high scholastic ability have work habits differing from those of students of lower scholastic ability who secure the same academic results in terms of grades. (The author, "Aiding the Fit," *Journal of Higher Education*, October 1935.) Nor can one assume that academic failure in college is solely due to a lack of intellectual ability. The late Dean J. B. Johnson made several studies of the scholastic-aptitude-test scores of students who had been dropped for poor academic scholarship. He found many students of high scholastic ability who failed in their work in college. The reasons for their failure apparently lay elsewhere than in lack of ability. (J. B. Johnson, *Who Should Go to College*, Minneapolis: University of Minnesota Press, 1930, pp. 19-20.) In a study by the author the average scholastic-aptitude-test score of a large number of students disqualified for reason of poor scholarship was only *one* point lower than the average test score of those remaining in college; that is, there was practically no difference in the average aptitude-test scores of those who failed and those who succeeded. (The author, "Scholarship and Habits of Work," *Proceedings of the Eighth Annual Convention of the Pacific Coast Association of Collegiate Registrars*, 1933, pp. 26-29.) It is quite apparent that not only ability but the way in which this ability is *used* is an important factor in scholastic achievement. The study leading to the construction of the *Inventory* was an attempt to isolate certain of these habit and attitude factors.

Briefly stated, the items of the *Inventory* are the habits and attitudes of study that were shown to be possessed in a significantly different degree by students of high academic achievement and students of low academic achievement who had been matched for intelligence-test ability, sex, length of time in college, scholastic load, and pattern of subject matter taken. The original study was made upon undergraduate students at Stanford University; the revision takes into account the results of an equally controlled study upon undergraduate students in the College of Science, Literature, and the Arts of the University of Minnesota.

In the Stanford study, which provided the basis for the first published edition of the *Inventory*, the records of the entire student body were sifted in order to select 110 pairs of men students, who were matched for scores upon the *Thorndike Intelligence Examination* (within one probable error of a score), field of study, scholastic load, and length of time in the University, but who were widely different in scholastic achievement. (Since only men were used, sex was automatically held constant.) One student of each pair was in the highest ten per cent of scholastic achievement in the student body, while the other was in the lowest twenty per cent of scholastic achievement. If significant differences could be found in the study habits of these students who were so far apart in achievement but so similar in certain other respects, a rea-

sonable conclusion could be drawn that these particular study habits had been influential in determining the marked differences in achievement. A list of 69 statements of study habits and attitudes was drawn up from a study of the research and expository literature on the subject, the vocabulary used in these statements having been checked by preliminary tryouts with groups of students. This check list of habits and attitudes was then submitted to the 110 pairs of students and they were asked to indicate whether each statement was true of their behavior "Often or always," "Sometimes," or "Rarely or never." Their replies were anonymous as far as names were concerned and they were promised the results of the study. There was little reason for them to check only what they might think were the "socially approved" responses or to give their replies carelessly. The return of the blanks was complete for 90 of the 110 pairs, a return of 82 per cent. An analysis was then made of the proportion of high-achievement students responding in any column of each item as compared with the low-achievement students; and it is upon this analysis that the items were selected and the scoring weights determined. This analysis will be briefly described in a succeeding paragraph.

Although the *Inventory* was used in large numbers throughout the country from 1935 to 1940, and with apparent satisfaction, the need for a similar study with another population has been constantly apparent. Such a study was undertaken as the subject of a master's thesis by Mr. Wilbur J. Humber, of the University of Minnesota, in 1939-40. The same controls were used in this study as in the original investigation, although the general aptitude test in this case was the American Council on Education *Psychological Examination*.

Mr. Humber included women in his population, although they were paired with each other and their responses were analyzed separately. The study habits of women high and low in scholarship showed far fewer differences than was the case with the men, the women having less than one-half as many items with significant differences as the men. The items of the *Inventory* that this study showed to have significance for women as well as for men are so marked on the scoring key. There have been very few controlled studies up to this time which have isolated the sex factor, although the number of pairs of women used in the current study was small and the sex differences indicated should be further verified before any general conclusions are drawn.

Almost all of the statements of habits and attitudes used in the first study were used in the second, together with additional items gleaned from certain more recent research in the field. A total of 71 items were submitted to the students. When the results of the Minnesota study were compared with the results of the Stanford study, four-fifths of the items of the published *Inventory* used in the second study were found to have as significant differences between high- and low-achievement groups as with the Stanford population. The results of this study were then utilized in modifying the scoring weights of the revised *Inventory*, in dropping certain items that did not show consistent or comparable differences, and in adding other items. The revised *Inventory*, then, profited from this corroborating study upon a different population but conducted with similar controls.

SELECTION OF ITEMS AND DERIVATION OF SCORING WEIGHTS

As previously stated, the selection of items was based upon the differences found in the percentage of high-achievement students and low-achievement students stating that they possessed a given habit or attitude in the degrees of "often," "sometimes," or "rarely." The differences, and the significance of those differences by the familiar "critical ratio" method, were computed for each of the three responses for each of the items. An item was considered for inclusion in the *Inventory* if the ratio between the percentage differences of the two groups and the standard error of that difference was two or more for any of the three possible responses. This means, of course, that even for a critical ratio of two there are 95 chances in 100 that the difference found is not the result of chance fluctuations. As a result of checking the first study with the second, both as to quantitative differences found and as to the consistency or direction of the differences, twenty-two items from the original published *Inventory* were retained and six others added in the revision. All of these items have critical ratios of at least two, while 17 have ratios of three or more.

The scoring weights were derived from a formula used in the determination of the weights of such tests as Strong's *Vocational Interest Blank*. This formula, devised by Professor Truman L. Kelley, now of Harvard University, takes into account the size and significance of the percentage difference and the position of the percentages on the normal distribution curve.

In the computation of the weights for the first edition of the *Inventory* a second weighting method, with a different theoretical approach, was used as a check. In this the weight for any item-response was the square (see L. D. Weld, *Theory of Errors and Least Squares*, p. 156) of the quotient produced by dividing the percentage difference by the probable error of this difference. When the 180 criterion papers were scored by both methods the amount of overlapping of the high-scholarship and low-scholarship distributions was almost identical (by the Strong method 9 per cent and by the second method, 8 per cent of the high-scholarship group had total scores below the median of the low-scholarship group).

A plus weight means that the response on the item was given by more high-achievement than low-achievement students, in other words, that the response is in the direction of high scholarship. Conversely, a negative or minus weight means the response is more characteristic of low-achievement students. The size of the weight indicates somewhat the significance of the difference between the two groups; that is, a weight of +7 indicates that a greater proportion of high-scholarship than of low-scholarship students made this particular response than would be the case with a weight of +6 or less.

Reliability and Validity

Since the *Inventory* is a check list of 28 study habits of unknown degrees of discreteness, rather than a test in the ordinary sense of the word, there is no suitable method that is at present known to the author for de-

termining its reliability. Likewise, ordinary methods of determining validity do not apply. The care with which the criterion groups were selected is one measure of validity inherent in the *Inventory* itself. The second study, which was made upon a different population and which to a very large degree confirmed the results of the first study, is another indication of the validity of the individual items. Comparison with grades, another common test of validity, is indicated below.

The algebraic sum of the weights gives a total score that is quantitative and is sometimes used for comparison with other data or for determining the standing of one student in a group in terms of a general pattern of study habits. Since the usefulness of the *Inventory* lies in the clinical significance of a given study habit for a given student—that is, where an individual item gives an indication of a "good" or "bad" study habit—the use of total scores is likely to be of relatively small importance in counseling. In attempts to secure a measure of validity, however, several studies have been made wherein the total *Inventory* score has been correlated with general-aptitude-test scores and with grades. In three studies, made by research workers other than the author, the correlation of total scores on the first edition of the *Inventory* with grade-point averages varies from .24 to .58. In the most recent study, made by a student under the direction of Dr. Frances Triggs of the University of Minnesota Testing Bureau, the correlation between *Inventory* scores and grades for one hundred students gave a coefficient of .42. When aptitude-test scores were held constant, this coefficient dropped only slightly, to .39. Since it is recognized by all that several factors enter into scholastic achievement, the coefficients given above between *Inventory* scores and grades are about as high as one could expect for the single factor of study habits. A careful item study of the *Inventory* has also been projected by Dr. Triggs in an attempt to determine item relationships and item discreteness.

Price Scale

25 tests, \$1.25; 100 tests, \$3.50; 500 tests, \$15.00;
1,000 tests or more, per hundred, \$2.50

Address orders to
Stanford University Press, Stanford University, California

STUDY-HABITS INVENTORY

Revised Edition, 1941

By C. GILBERT WRENN

Author of *Studying Effectively, Study Hints for High School Students, etc.*

Assisted in the original edition by R. B. McKeown
and in revision by Wilbur J. Humber

STANFORD UNIVERSITY PRESS, Publishers

Name..... Date.....

School Grade..... Age..... Sex.....

Institution.....

Probable college major.....

Directions

The following is a list of statements of habits and attitudes which may affect use of study time and consequent success in school work and study. You are asked to state your habits with regard to these items, not in accordance with what you think you should or should not do, or what you see others do, but *in accordance with what you yourself are in the habit of doing*. Please answer all questions.

After each statement, you will find columns 1, 2, 3. *Place a check mark (X) in the column which you feel most nearly describes the truth of the statement in your own case now.* Remember that this is a survey of your present practice. Check it in accordance with the following key:

Column 1. *Rarely or never true in my case.*

Column 2. *Sometimes true in my case.*

Column 3. *Often or always true in my case.*

STUDY-HABITS INVENTORY

A. Reading and Note-taking Techniques

1 Rarely or Never	2 Some- times	3 Often or Always	Score
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1. I have to re-read material several times—the words don't have much meaning the first time I go over them.....
2. I have trouble picking out the important points in material read or studied; tend to take down material which turns out to be unimportant.....
3. I go back and recite to myself the material studied—rechecking any points I find doubtful
4. I pronounce the words to myself as I read
5. I miss important points in the lecture while copying down notes on something which has gone before.....

B. Habits of Concentration

6. I find it hard to keep my mind on what I am studying—don't know what I have been reading about when I get through
7. I have a tendency to "day-dream" when trying to study.....
8. It takes me some time to get settled and "warmed up" to the task of study.....
9. I have to wait for "the mood to strike me," or for "an inspiration" before starting a task; I am likely to waste time

C. Distribution of Time and Social Relationships in Study

10. My study periods are often too short for me to get "warmed up" and concentrated
11. My time is unwisely distributed; I spend too much time on some things and not enough on others.....
12. My periods of study are interrupted by outside interference such as telephone calls, visitors, and distracting noises....
13. I find it hard to force myself to finish work by a certain time, under pressure; work is unfinished, inferior, or not in on time
14. I study with others rather than by myself

	1 Rarely or Never	2 Some- times	3 Often or Always	Score
15. My enjoyment of loafing, "bull-sessions," or "chewing the fat," interferes with my study.....				-----
16. I spend too much time reading fiction, going to shows, etc., for the good of my school work				-----
17. Too much social life interferes with my school success—dances, dates, and trips				-----
D. General Habits and Attitudes of Work				
18. I get "fussed" and nervous on exams—blow up and can't do myself justice or tell what I know.....				-----
19. I plan out in my mind the answer to a subjective or essay-type examination question before starting to write the answer				-----
20. I finish my examination papers and turn them in before time is called on the examination				-----
21. I try to get each point as I go over it, rather than to go on at the time and then go back later to clear up doubtful points				-----
22. I try to carry over and relate material learned in one course to that learned in others				-----
23. I try to summarize, classify, and systematize the facts learned, associating them with previously learned material and facts				-----
24. I am conscious that I have been out of school too long, or took basic subjects too long ago.....				-----
25. I try to do some "over-learning," working beyond the point of immediate memory or recall.....				-----
26. I find myself too tired, sleepy, and listless to study efficiently.....				-----
I have to study where I can smoke—must "go out and have a smoke" when working at the library, etc.				-----
28. Dislike of certain courses and professors interferes with my school success				-----

and the "moral" of the story is that
the author's wife is a "good" woman
and the author's son is a "bad" boy.
The author's wife is a "good" woman
and the author's son is a "bad" boy.
The author's wife is a "good" woman
and the author's son is a "bad" boy.

André Gide

The "moral" has been

and a imagination has "invent" the book
as well as the author's wife and the son.
And I think that
of course the author's wife and the
author's son are good and bad
but the author's wife and the son
are good and bad.

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The attention of the undersigned has recently been called to two research studies using the Study-Habits Inventory. In both studies, one at Ohio State University and one at the University of Georgia Extension Division, the Inventory's structure and purpose were warped through its employment as a research instrument. The Manual of this instrument states: "This Inventory should not be understood as a test in the ordinary sense of the word. It is a weighted check-list of study habits....the Inventory does not conform to the established criteria for a test and should not be so considered."

The Study-Habits Inventory is a diagnostic, clinical instrument in which each item must be considered separately. There is no assurance that the total score represents a study-habits entity. The Inventory's proved value is as a tool to represent to individual students the individual habits which may hinder or promote scholastic achievement. Its value as "an orientation device, diagnostic in nature" is attested by repeat orders from colleges, high schools, and other educational institution.

A considerable amount of research data is under consideration this year in an attempt to verify items, verify weights, and construct a scoring scale for high-school students. Its present scoring scale is valid for college students and for high-school seniors preparing for college, since its original validation was against these college grades.

These uses are plainly set forth in the Manual, which should be read with care by anyone desiring to derive from the Inventory its greatest service - individual-item diagnosis.

C. Gilbert Wrenn
Stanford University

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